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VIEWS, NEWS AND INTERVIEWS.

An investigation by Dr. Richter, of Hamburg, Germany, shows that most of the fires that occur in laundries where benzine is used to wash clothes are due to electric sparks caused by friction of the benzine and the clothing as the latter is withdrawn from the bath. In Hamburg alone, 15 out of 21 fires were due to this cause. Experiments showed that woolen materials become positively electrified and the benzine negatively, and that the difference of electrical tension causes a discharge strong enough to give a painful shock, producing sparks two inches long in some instances, and lighting up the room in which the experiments were made. It is suggested that such fires may be prevented by charging the air in the room with steam.

A proposal has been made to establish a telephone exchange in Ceylon, to which all the various tea estates would be connected.

A record was delivered at the office of the clerk of the Supreme Court of the United States at Harrisburg, Pa., which bore testimony to the complaint of the late Justice Miller that "records in these days are made up largely for the benefit of printers." The title of the case is "The Consolidated Electric Light Company vs. The McKeesport Light Company," and in it is involved the great contest being waged between the leading electric light corporations of the United States. The record comprises three large volumes and its printing costs $17,000. This includes the cost of engraving, there being a great number of illustrations in the work.

Ball bearings have recently been perfected to a wonderful degree. It is reported that a street car, which was equipped with the latest inventions in ball bearings, that would do away almost entirely with friction, was drawn a distance of several hundred feet by a single man tugging gently at three strands of ordinary sewing thread attached to the car. Perhaps a more interesting experiment was that of a carriage manufacturer in the West, who put another style of ball bearings upon the wheels of a large coach to which four horses were ordinarily hitched. Then he took a trained dog and harnessed and hitched him to the pole, when the dog drew a huge coach easily around the yard.

A press dispatch from San Francisco, under date of January 28, states that "a heavily laden electric car overturned at the corner of Cherry and Thirtieth streets last night, injuring 21 out of 90 people aboard." It is against the rules of most Eastern street railway companies to allow passengers to ride on the roofs or trucks of cars.

Can You Supply this?

A subscriber to the ELECTRICAL REVIEW will pay 25 cents for a copy of this journal for March 19, 1892.

A Large Telephone Submarine Cable Successfully Laid.

On Monday, January 29, a large telephone submarine cable was successfully laid under the East river from the foot of Thirty-eighth street, New York, to a dock at the foot of Eighth street, Hunter's Point. The cable was made by the Safety Insulated Wire and Cable Company, at their factory in West Twenty-ninth street, for the Metropolitan Telephone and Telegraph Company. It is 5,000 feet, or nearly a mile long, two and three quarter inches in diameter, and weighs 21½ tons without the reel. It contains 20 conductors, each consisting of three pure soft copper wires, No. 22 B. W. G., and having a conductivity of 98 per cent. Each conductor weighs 37½ pounds per mile and is insulated with an evenly distributed seamless covering of "safety" submarine compound to an outside diameter of one-quarter inch; then served with a close layer of light tarred tape. The system of forming the cable is as follows:

A LARGE TELEPHONE SUBMARINE CABLE.

A central core is first formed of a group of four of the taped conductors, laid up helically with a jute serving. The lay of the conductors is about six inches, and the jute serving is applied so as to make a cylindrical core of the group of four. This core is protected with a covering of light tarred tape. The remaining 16 conductors are twisted in pairs, the length of the twist being about six inches. Each pair is laid up with a jute serving so applied as to make a cylindrical core. The eight pairs of conductors so formed are then laid up helically about the central core, the length of the lay being about 18 inches, and its direction opposite to that of the central core. The cable is protected with one covering of heavy tarred tape and served with two layers of tarred jute. Above the jute serving is placed an armoring of 22 galvanized iron wires, No. 3 B. W. G., put on without twisting, and with a lay of 20 inches. Above the armoring are placed two coverings of hemp, laid on in reverse directions, each covering saturated with a preservative compound. The completed cable is then treated with a liberal coating of compound to prevent the turns from sticking together on the reel.

The reel on which the cable was wound weighs a ton and a-half. Our illustration on this page shows the reel on the truck used to transport it. Nine pairs of horses were required to get itfrom the factory over to the Thirty-eighth street dock. There it was put aboard the "Western Union," a large twin-screw tug belonging to the telegraph company of that name, and especially fitted up for the purpose of laying submarine cables. G. C. Allen, one of the superintendents of the Metropolitan company, was there to look after its interests, and L. F. Requa, treasurer of the cable company, was present on behalf of his concern.

At 2:25 o'clock the "Western Union" got under way, and in six minutes, or in less time than it takes a ferryboat to cross, it had left 21½ tons of cable behind it, in spite of wind and wave and storm. The cable was wound around an immense power wheel on the forward deck of the steamer and paid out by its own weight through a pulley arrangement attached to the end of a big boom projecting about 15 feet from the starboard side.

The cable was placed in active service early on Saturday morning, February 3. It conveys the trunk lines that connect the Eighteenth, Thirty-eighth, Seventy-ninth street and Harlem exchanges with those of Greenpoint, Astoria, and Flushing. On this side the river the lines connect directly with the subway lines of the Metropolitan Company at Thirty-eighth street.

The specifications and requirements for a telephone cable for the Metropolitan Company are very rigid. An insulation resistance of at least 600 megohms per mile is insisted upon. A test made last week shows the insulation of this cable to be nearly 1,500 megohms or about two and a-half times the specified insulation. This certainly should be cause for congratulation to the Safety Insulated Wire and Cable Company.

STORAGE BATTERY TRACTION AT WASHINGTON, D. C.

A REPLY TO MR. MAYNARD FROM PRESIDENT WM. BRACKEN, OF THE CONSOLIDATED ELECTRIC STORAGE COMPANY — MR. BRACKEN SPEAKS FROM LONG EXPERIENCE AS A FRIEND RATHER THAN A CHAMPION OF THE STORAGE BATTERY— A PECULIAR COMBINATION OF CIRCUMSTANCES AT WASHINGTON.

TO THE EDITOR OF ELECTRICAL REVIEW:

I desire to be heard in your valuable journal in reply to the article of Mr. George C. Maynard in your issue of January 31 on "Storage. Battery Traction on the Metropolitan Railroad in Washington." While Mr. Maynard seems to be sincere in what he says, yet he is unjust in attributing the failure of the Washington experiment to the storage battery. The failure was chiefly attributable to the men who conducted the experiment. Mr. Maynard may not be aware of this. He may not have learned the true history of that experiment. I will endeavor to give it to you as I have been informed and believe.

The gentlemen referred to by Mr. Maynard as carrying on this experiment, namely, Messrs. Pearson, Mailloux and F. H. Chamberlain, experimented with one car carrying a standard storage battery (by standard, I mean a Brush or Faure type, as you may choose to call it), and became satisfied from the manner in which that car did service that storage battery traction was practical and economical. This experiment was conducted before any of the enormous outlay subsequently made had been determined upon. At the end of the experiment, Mr. Pearson and some of his associate directors listened to the voice of the siren and organized, as I am informed, a corporation distinct from the Metropolitan Railroad, for the purpose of owning, exploiting and forever enjoying the ideal storage battery system of Mr. Mailloux; which system was to consist of a brand new type of battery not infringing any of the existing patents, and a motor of peculiar construction, especially adapted to storage battery traction. As a giant sample and exemplar of this ideal system, an enormous sum of money, some hundreds of thousands of dollars, was spent; first, in building a large storage bat-

tery station and power house; secondly, in constructing and equipping some 40 or more cars; and thirdly, in a laboratory and test room, where day in and day out the perfect battery and the perfect motor were being evolved. It is true that this is in the inverse order of natural events, the invention at least usually preceding the building of power houses and cars. But perhaps this was only another stroke of unappreciated genius on the part of the inventor. Whether the vast sum of money to do all this was furnished by the Metropolitan Railroad Company, or by the Ideal System Company, I am not informed. It is only fair to the promotors to presume that the Ideal System Company furnished the money. The station and power house was built, and filled with big machines and complex devices. Scores of cars were also built, and might be seen in the car loft. But there was no appearance of a battery, nor of a motor. After months and months of weary waiting for the battery and the motor, it gradually dawned upon Mr. Pearson that he had possibly made a mistake. This idea soon crystalized into a conviction, whereupon the chief electrician left, and Mr. Chamberlain was promoted to his place. Mr. Chamberlain would not be an electrician and an inventor if he did not start in to undo everything that his predecessor had done. The switches and regulators were all wrong, etc. Mr. Pearson called in all the storage battery doctors in the country—allopathic, homœopathic and eclectic. But it was too late. The disease had gone too far; and even Mr. Pearson had to go. Of course the doctors last called in were "no good," because they could not redeem a patient beyond redemption.

The above is an instance, dear Mr. Editor, in which the poor, over-abused storage battery should not be so uncharitably dealt with; and it is as its friend, rather than its champion, that I have felt it my duty to give you the above facts.

Respectfully yours,

WM. BRACKEN.

New York, February 2, 1894.

Another Incandescent Lamp Decision.

Below will be found the full text of the opinion of Judge Acheson in the three cases of Edison Electric Light Company and the Edison Electric Light Company, of Philadelphia, against (1) the Philadelphia Trust, Safe Deposit and Insurance Company, (2) the Manufacturers' Club, of Philadelphia, and (3) the Spreckels Sugar Refining Company, filed in the United States Circuit Court for the Eastern District of Pennsylvania, January 25, 1894:

Acheson, Cir. J.: The patent in suit No. 223,898, granted on January 27, 1880, to Thomas A. Edison, after protracted litigation and a most vigorous defense, was sustained by the Circuit Court of the United States for the Southern District of New York, and by the Circuit Court of Appeals for the Second Circuit. (Edison Electric Light Company *vs.* The United States Electric Lighting Company, 47 Fed. Rep., 454; 52 Fed. Rep., 300; Edison Electric Light Company *et al. vs.* The Sawyer-Man Electric Company, 53 Fed. Rep., 592.) The uncontradicted proofs in the several cases now before me show infringing use by the defendants respectively, and it is conceded that the plaintiffs—Edison Electric Light Company and its exclusive licensee in the city of Philadelphia, the Edison Electric Light Company, of Philadelphia—are entitled to a preliminary injunction in each of these three suits. The court, however, is asked to exempt from the operation of the injunction certain lamps (confessedly within the second claim of the patent) which were manufactured by the Columbia Incandescent Lamp Company, a corporation of the State of Missouri, for the reason that, in a suit brought against that company by the Edison Electric Light Company and the Edison General Electric Company in the Circuit Court of the United States for the Eastern District of Missouri after the decisions in the Second Circuit, Judge Hallett refused a motion for a preliminary injunction upon the defendants giving bond in the penal sum of $20,000, conditioned for the payment of any sums which might be decreed in that suit in favor of the complainants therein (56 Fed. Rep., 496). The ground for this refusal was a defense then set up, which had not been made in the Second Circuit, that the incandescent electric lamp for which Edison was granted the patent was really the prior invention of one Henry Goebel. But in the earlier case of the *Edison Electric Light Company vs. Beacon Vacuum Pump and Electrical Company*, 54 Fed. Rep., 678, that defense was interposed to a motion for a preliminary injunction, and was very carefully investigated by Judge Colt, who found and decided that Goebel's story of his invention in itself was so improbable, and the evidence to sustain the alleged anticipation was of such doubtful character, that the consideration of this defense ought to be postponed until final hearing, and that in the meantime the plaintiff was entitled to enjoy the fruits of the decree sustaining the patent. Accordingly, Judge Colt granted a preliminary injunction.

In the more recent case of the Edison Electric Light Company *vs.* Electric Manufacturing Company, 57 Fed. Rep., 616, in the Circuit Court of the United States for the Eastern District of Wisconsin, Judge Seaman expressed views similar to those of Judge Colt, and awarded a preliminary injunction to restrain infringement of this patent.

No evidence whatever in support of the Goebel defense has been submitted to me, so that I am without means of forming an independent opinion as to whether it rests upon a substantial basis. Under all the circumstances, then, to give to Judge Hallett's refusal to grant an injunction the effect here claimed for it would be to carry the principle of judicial comity to a most extravagant length. The Edison Electric Light Company, of Philadelphia, vitally interested here, is not a party to the Missouri suit. But aside from that consideration, the owner of a patent undoubtedly may maintain suits for infringement against the manufacturers and users of the patented device simultaneously. (Birdsell *vs.* Shalliot, 112 U. S., 485; Kelley *vs.* Ypsilanti Dress Stay Manufacturing Company, 44 Fed. Rep., 19.) True, pending a test suit against a manufacturer involving the validity of a patent in which a preliminary injunction against him has been decreed, courts in other jurisdictions have declined to enjoin preliminarily the users of the device. But the Edison patent has been sustained under circumstances which entitle the adjudication to high regard. It is the accepted doctrine that the decision of the Supreme Court, after exhaustive litigation upon the merits sustaining a patent, will ordinarily be regarded as conclusive on a motion for a preliminary injunction, the presumption against the existence of any valid defense against the patent prevailing at that stage of the case. (Purifier Company *vs.* Christain, 3 Bann & Ad., 42, 51; American Bell Telephone Company *vs.* Southern Telephone Company, 34 Fed. Rep., 795; American Bell Telephone Company *vs.* McKeesport Telephone Company, 57 Fed. Rep., 661.) I think the same effect ought here to be accorded to the dicision of the United States Circuit Court of Appeals for the Second Circuit, sustaining the Edison patent.

In each of these cases a preliminary injunction in the form prescribed by the Courts of the Second Circuit will be allowed.

A New Book.

"Dynamo and Motor Building for Amateurs," with working drawings. By Lieut. C. D. Parkhurst, U. S. A. 163 pages. 71 illustrations. Price, $1.00. Sent postpaid, on receipt of price, by the ELECTRICAL REVIEW Publishing Co., 13 Park Row, New York.

In this book clear and concise instructions, accompanied by working drawings, are given for the construction of such forms and types of motors and dynamos as are simply made, and yet will produce fairly efficient results. While primarily intended for the amateur, the detailed information, particularly in the chapters on armature windings, connections and currents, and on the design of a 50-light dynamo, will be of value to every electrician.

Full descriptions and working drawings are given for the following machines:

A small bi-polar shuttle armature motor of a simple construction, capable of driving a small ventilating fan with current from a primary battery.

A small motor for driving a sewing machine, for which no castings or patterns are needed.

A sewing machine motor of more finished appearance and of greater efficiency than the above, being of a regular factory-made type.

A dynamo of modern type, capable of lighting 50 sixteen candle-power lamps of 125 volts.

A chapter on armature windings, connections and currents gives minute instructions, illustrated by drawings, in regard to these subjects, and based upon the latest and best practice.

THE SUBURBAN ELECTRIC LIGHT STATION.

THE INTELLIGENT GENERAL MANAGER—A UNIQUE WAY OF MEASURING CANDLE-POWER—BUT A SMALL FORCE OF EMPLOYÉS NECESSARY.

The electric light and power house of a suburban village is a very interesting place to visit, not that it contains magnificent machines and elements of wonderment, but here, it seems, one can see a peaceable running little plant, superintended by an individual who generally acts in a sort of Pooh-Bah capacity. He is often termed the general manager, and this, too, is a very comprehensive term, for it may mean that he may be secretary, treasurer, engineer-in-chief, assistant engineer, fireman, and maybe assistant fireman. We find him when the latter person is out to lunch, or on a vacation, busily attending the fires and anxiously watching the safety valve. We will often find that he is a college graduate or some favorite of the richest man in the town, who, having implicit confidence in his protegé, placed him in control of the works which he and his fellow-townsmen have erected to boom the town.

Such a little plant I had the pleasure of visiting recently. There was the secretary and treasurer busily at work repairing arc lamps which had burned out on the previous evening. Standing at the work bench, equipped with a few of the simplest tools, he entered heart and soul into the work—but I presume I ought to add parenthetically—(while I was there). He seemed to be, as I entered, laboring under some mental excitement. Possibly, I thought, some accident has happened, and his lights will not be turned on this evening, but upon approaching him I apprehended that there was a part of the lamp mechanism which was worrying him. He had got it apart, and seemed to be vainly endeavoring to get it together again. I offered my assistance. Quickly scorning it, for he knew everything, did this electrician, he plunged deeper into the mysteries of the wheels that would not go round, and finally succeeded in breaking the mechanism. This started a splendid subject for conversation, and he seemed rather ashamed that he had not accepted my proffered help.

"Do you have to make all the repairs?" I asked.

"Oh, no indeed," he answered quickly, "we have workmen to attend to that; I am just here to-day because he is sick;" and making sure that I understood the situation thoroughly, he repeated his last remark.

"Do you have many repairs?" I asked.

"Well, the only serious trouble we have," and he looked as if he meant to be serious when he said it, "is with our arc lamps, but we manage to get along pretty well."

At this point one of his lieutenants happened to need something, and calling the attention of the before-mentioned gentleman, in his capacity as treasurer, told him that the plant needed another supply of carbons. As secretary, he wrote a letter to the company from whom he was in the habit of buying carbons; in his capacity as general manager, he will see that the carbons are properly distributed in their respective bins, and as engineer, he will make a couple of very meek tests to prove, entirely to his own satisfaction, that the carbons were what he thought they should be.

"How do you test the quality of your carbons?" I asked, "or do you experience any variations in qualities?"

"Oh, yes," he replied, and then with careful minuteness he described the details connected with trimming the lamps, and attempted to show me the difference between two kinds of carbons. With all seriousness he explained and carefully illustrated with formulæ, learned in his recent college days, among which seemed to stand out prominently "the intensity of the light decreases as the square of the distance," the details of what he chose to call a comparative photometric determination.

The only instruments used, however, were those which nature furnished him, being placed one on either side of the somewhat prominent nose.

Further inquiry developed the fact that his knowledge of several other electrical instruments was somewhat limited.

"How does your plant pay?" I inquired.

"As regards the business end of the working," he replied, "everything is satisfactory. We sell our entire out-put, and if we had the space and machines for more lights, we would find no difficulty in supplying all who require it."

"Do the people in these small towns prefer electricity to gas?"

"That presents a very interesting aspect of the case," he replied. "As things now stand it would cost too much to put up a gas plant for such a small town, and no dividends could be paid; but with the case of an electric light plant such as this," which happened to be the alternating system, "the initial cost is very much less. Our plant cost $12,000. Thus, you see, we have a fair start of any gas company, and as the town grows we can very readily find means and the necessary capital for enlarging our plant. The rates we charge here are just the same as those charged in the city, and we have the additional advantage of cheaper line construction. We employ one man who does all our trimming and small repair work. He often works as a fireman and you can readily see that our pay-roll is comparatively small."

"Do you find a ready sale for the current in private houses as well as in business places?"

"No," he replied, "the demand so far is rather small, but as we have new houses going up, the owners will have them wired all ready for lighting, and it will be merely a matter of time before they fall into line with the other users.'

"Do you do your own construction work?"

"No, that we let out to contractors and sometimes we receive a small commission for so doing."

"I presume then that plants such as these may be considered safe investments in towns having a moderately large population, and it is, therefore, a good field for investors?"

"Our dividends will show that," he replied, "and, furthermore, we feel a little pride in having this small monopoly. We are, though, not quite yet in a position to dictate terms to the residents, for we feel that should we charge excessive prices the users would simply become apostates and go back to the kerosene lamp. This, of course, we could not afford to have them do so we simply jog along quietly, satisfied with small returns, but with the knowledge that at some future time, when residents become more plentiful, we shall have a firmer foothold and feel more secure in our position: in other words, we will become indispensable."

JULIAN A. MOSES.

New York Board of Electrical Control.

At a meeting of the New York Board of Electrical Control on January 29, the New York Auxiliary Fire Alarm Company received a franchise permitting it to put auxiliary fire alarm boxes on the floors of buildings in the city to connect with the boxes of the fire department. The board refused the application of the New York Heat, Light and Power Company for permission to lay a subway in Nassau street, from Maiden Lane to Spruce street.

Telephonic Communication in Japan.

The meteorological stations in Japan, of which there are 40, are being connected together by telephone. Thirteen stations are already in communication.

A History of the Telephone.

READ BEFORE THE CHICAGO ELECTRICAL ASSOCIATION, JANUARY 23, 1894,

BY W. CLYDE JONES.

It was in 1819 that Oersted, a professor in the University of Copenhagen, while lecturing to his class, discovered that a magnetic needle, when held in the vicinity of a wire traversed by an electric current, was caused to assume a position at right angles to the axis of the wire. This experiment, though simple of performance, was a revelation to the scientific world, and confirmed the long-standing suspicion that electricity and magnetism were, in some mysterious manner, related. This was the spark that inflamed the minds of scientific men and led to the unraveling of the apparent mysteries of electro-magnetic action, and the founding of the laws of electro-magnetism to which we are in such a great measure indebted for the industrial development of the electrical arts.

Oersted had informed the world that there was a relation between electricity and magnetism, but it remained for Sturgeon, in 1825, to point out that there was not only a relation, but that electricity was even convertible into magnetism. He had encircled a bar of soft iron with a helix of wire, and noted that upon the passage of an electrical current through the helix the soft iron bar assumed the properties of a magnet. Here was the germ that was afterward developed into the telegraph and the telephone.

With the electro magnet the minds of men naturally turned to the transmission of intelligence to a distance, and in the years immediately following Sturgeon's experiment we find the greatest scientific minds busily engaged with the problem. Neither the laws of the electro-magnet, nor the laws governing the passage of a current along a wire, since so admirably expressed by Ohm, were at this time known, and the rapid falling away of the force of the current with increased distance led to the belief that an electro-magnetic telegraph would never be possible. Indeed, in 1829 Professor Barlow, of England, perhaps the foremost scientist of his day, after making an exhaustive study of the problem, published a demonstration, considered at the time conclusive, showing that it would be absolutely impossible to transmit intelligence to a distance by means of the electro-magnet.

But soon the dormant hope was again aroused by the publication of the researches of Joseph Henry, who had so thoroughly investigated the laws of the electro-magnet that no discoveries except of minor importance have resulted from later investigation; in fact, the electro-magnet as Henry knew it in 1830 is the electro-magnet as we know it to-day.

Ever since Sturgeon had converted electricity into magnetism, the question ever uppermost in scientific minds was whether magnetism might not in turn be converted into electricity. It was in 1831 that Henry and Faraday discovered that magnetism was, in fact, convertible into electricity and was effected by varying the magnetic field threading a looped conductor. By this discovery, which has rendered illustrious the names of two great men, the world acquired the information concerning the laws of electro-magnetism, and the mutual convertibility of the two mysterious forces, that immediately removed the electrical science from the domain of the purely theoretical and experimental and gave it a place in the industrial world.

The time was now ripe for the development of the electric telegraph, and in the early thirties Samuel F. B. Morse had conceived the electric telegraph, which, toward the end of the decade, assumed practical form. With Sturgeon's electro-magnet placed at the distant end of the line, he closed an electric circuit by means of a key, thus causing the electro-magnet to attract its armature and convey to the operator at the distant end of the line the conventional signal.

Naturally, the operation of the Morse telegraph suggested the possibility of transmitting the voice itself to a distance; and indeed, as early as 1854, we find Charles Boursel publishing to the world the possibility of speech transmission in words that have since become historic. He said:

"I have asked myself if the spoken word itself could not be transmitted by electricity; in a word, if what was spoken in Vienna may not be heard in Paris? * * *

"Suppose that a man speaks near a movable disk sufficiently flexible to lose none of the vibrations of the voice; that this disk alternately makes and breaks the connection with the battery, you may have at a distance another disk which will simultaneously execute the same vibrations."

Boursel erroneously supposed that the voice could be transmitted by the opening and closing of the circuit, and thus outlined a path of research which science traveled for 20 years, until Bell, by his theory of electric undulations, removed it from the deeply worn rut. In 1861 Philip Reis, of Frankfort, Germany, apparently following the instructions of Boursel, constructed the first telephone which comprised as a transmitter a diaphragm, adapted in its vibration to open and close an electric circuit. At the receiving station was placed an electro-magnet, which by the successive current impulses sent over the line by the transmitter caused the magnet to alternately attract and release its armature, to which was secured a thin plate which in vibration of the armature was moved back and forth, thus beating the air and setting in motion the air particles that conveyed to the ear the sense of sound.

By comparing the telephone of Reis with the telegraph of Morse, it will be observed that the transmitting instruments differ only in that Morse used a key actuated by the hand for opening and closing the circuit, while Reis provided a diaphragm, which for the sake of the analogy we may consider a key adapted to be actuated not by the hand but by the vocal organs. Again, the only essential difference between the receiving instruments was that Reis had applied to the armature of the Morse instrument a thin plate for the purpose of setting the air particles in motion.

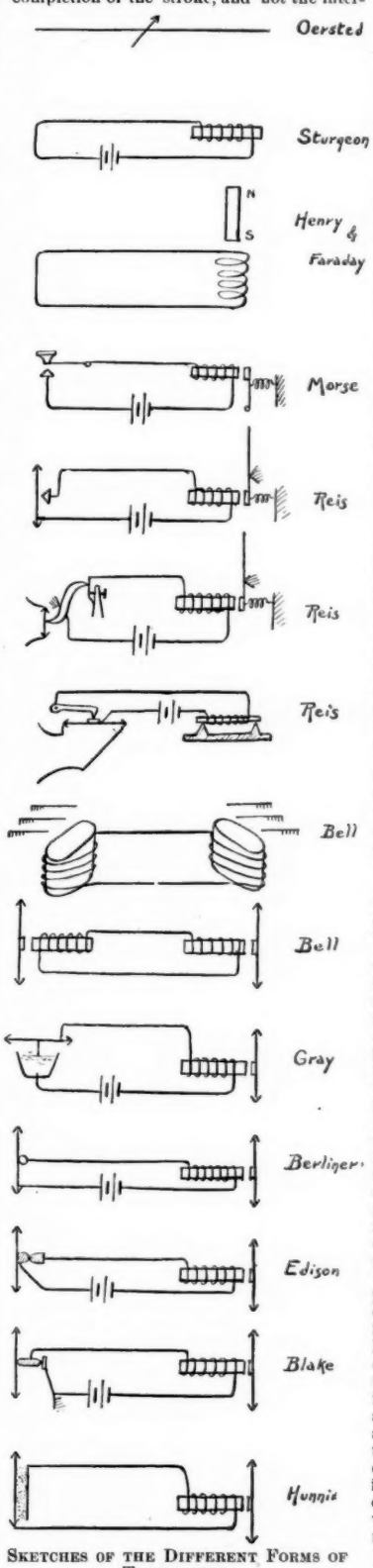
Reis, by opening and closing the circuit, was unable to transmit the complex current undulations, upon which we know the transmission of articulate speech to depend, and was only able to transmit simple musical sounds. It has been contended by some that Reis actually transmitted articulate speech by means of his apparatus, and understood the requisite of speech transmission; and, in fact, speech has actually been transmitted by the Reis apparatus, by causing the contacts of the transmitter to remain continuously in contact; but that Reis himself did not understand the necessity of an undulatory current, and did not transmit speech, may be inferred from the fact that in his later apparatus, which was by him considered an improvement upon the former, the construction was such that it is impossible to cause the contacts to remain continuously in contact.

In the former instrument a pivoted lever was provided, one end bearing against the diaphragm and the other against the end of a spring, the circuit being from the lever to the spring. As the diaphragm vibrates, the end of the lever is moved toward and from the spring to close and open the circuit. A screw was provided for adjusting the end of the spring toward and from the end of the lever, and by a proper adjustment the end of the lever may be caused to remain continuously in contact during the vibration of the diaphragm, an undulatory current being thus produced for the transmission of articulate speech. In the later instrument the diaphragm was horizontal, one contact being carried at its center, while the other comprised a lever resting loosely by its end upon the first contact. As the diaphragm vibrates, the end of the lever is successively thrown away from the diaphragm to open and close the circuit. By this construction it will be observed that the contacts cannot be caused to remain continuously in contact.

It will be observed that there is a remarkable resemblance between the receiver of Reis and the magneto telephone of Bell, the difference being that Bell secures the thin plate by its edges and provides the armature at its center, while Reis mounts the plate upon a horizontal axis and places the armature upon one end. In both, the function of the plates is to beat the air; in both, the function of the magnet and armature is to set the plate in motion.

We see, therefore, that Reis actually had a receiver capable of reproducing articulate sounds, had he but understood the necessities of the transmitter, and that by adjusting his transmitter so that the contacts would remain continuously in contact, he would have had an articulating transmitter. Further than this, had he connected two of his receivers together, and used one as a transmitter, speech might have been transmitted. With apparatus of such possibilities, it does, indeed, seem remarkable that the mere oversight of not having turned a screw a fractional rotation on its axis, or of not having connected two particular binding posts by a wire, should have shifted the honor of having first transmitted articulate speech from the shoulders of Reis to those of men living half a generation later.

The apparatus of Reis, as Reis used it, was incapable of transmitting articulate speech, since the only effect of each vibration of the diaphragm was to close the circuit of a battery and send a current impulse over the line. These current impulses being always of the same strength, the vibrating plate of the receiver always produces tones of a given loudness, but as the rate of vibration of the transmitter varied, the rate of vibration of the receiver plate correspondingly varied, the apparatus being thus capable of reproducing the pitch of the sounds. But in complex sounds, and particularly sounds comprising articulate speech, the air particles do not perform a simple to and fro movement in constituting the sound, but perform the cycle with more or less complexity, now advancing rapidly, now slower, perhaps receding slightly and then advancing to complete the stroke; and it is evident that any transmitter that fails to register all of these variations will fail to transmit articulate speech. Since the transmitting diaphragm of the Reis telephone merely registered the completion of the stroke, and not the intermediate movements, it was, of course, incapable of transmitting articulate speech.



SKETCHES OF THE DIFFERENT FORMS OF TELEPHONES.

In the early seventies, Alexander Graham Bell was working upon a harmonic telegraph, which in its essential features comprised a permanent magnet, opposite the pole of which were located a number of reeds, each adapted to vibrate at a different rate. Encircling the magnet was a coil of wire, connected with the coil of a similar instrument at a distance. When one of the reeds was set in vibration it executed a definite number of vibrations, the number being peculiar to the reed, and the successive approach of its end to the end of the magnet varied the strength of the magnet, thus inducing in the coil a current which, traversing the coil at the receiving station, varied the strength of the magnet which it encircled to cause the successive attraction of a reed having the same characteristic vibration. None of the reeds at the receiving station thus vibrate, except those whose correspondents at the transmitter vibrate, and if a number of the reeds at the transmitting station are caused to vibrate the corresponding reeds at the receiving station are set in vibration.

Now, since complex sounds may be resolved into a number of superimposed simple sounds, Bell concluded that if the reeds be mounted flexibly enough to vibrate under the influence of sound waves, and are sufficient in number, a person in speaking against such reeds would set such reeds, the vibration of which when compounded produce the sound, into vibration, thus causing the corresponding reeds at the receiver to vibrate and reproduce the sound. From this conception of the production of all the simple tones of which the complex tone is composed, Bell, taking a lesson from the human ear, advanced to the conception of a diaphragm, which should have not a characteristic vibration to respond to a particular sound, but which should respond to all sounds, and the development of this idea led to the production of the magnetic telephone.

Elisha Gray was at this time also working upon a harmonic telegraph, and independently conceived the requisite of speech transmission. His receiver embodied the principle of Bell's telephone, but for a transmitter he provided means for producing changes in the resistance of an electric circuit by the variable immersion in a body of mercury of a needle carried upon the diaphragm, the needle and the mercury being included in the circuit.

It soon became evident that the electro dynamic or resistance varying telephone of Gray was the best for transmitting the sounds, and the improvements of Berliner, Edison and Blake soon followed. After an interference in the Patent Office, it was decided that Berliner was the first to conceive the use of two electrodes continuously in contact for varying the resistance; that Edison was the first to provide electrodes of carbon, while Blake first mounted the electrodes upon springs in a manner to prevent the breaking of the circuit, and employed platinum as one electrode.

The variations of current produced by solid electrodes is limited, and the transmitter has been improved by Hunning by using granular carbon between a stationary plate and the vibrating diaphragm, a greater variation of resistance for a given movement of the diaphragm being thus secured.

The Hunning transmitter, with improvements for preventing the caking of the granular material, marks the highest stage of development of the telephone transmitter.

Thus we see that the development of the telephone has been a gradual one, and has followed a logical course, and is perhaps one of the most striking examples of the fact that great inventions do not spontaneously emanate from the mind of one great man far in advance of his age, but that each but adds his mite to the amassed knowledge of society, the process continuing until some one happily supplies that last step which, added to what has been done before, carries the undertaking within the pale of success, the last step being perhaps of no greater intrinsic merit than the others; but by virtue of its position, like the keystone that completes the arch, it becomes of the greatest relative importance. The steps, when considered in the light of retrospect, often seem small indeed, yet they were all necessary to accomplish the completed journey. Thus we see that Morse did little more than provide a key for Sturgeon's electro-magnet. Reis did but little more than substitute for the manual key of Morse, one more sensitively constructed, to be operated by the vocal organs, and instead of pounding a metal stop with the armature of the electro-magnet, pounded the air. Bell did but little more than mount the plate of Reis as a diaphragm and conceive the idea of using it as a transmitting instrument to produce the all-essential undulatory current, and in fact all of the variable contact transmitters are but little more than the Reis transmitter properly adjusted. But while we, standing at a distance, are thus able to verify the words, well said, that "science moves but slowly, slowly, creeping on from point to point," we must not forget that the act is more difficult in the performance than in the after contemplation, and that all of those to whom we are indebted for the perfection of the telephone from Oersted to Hunning, merit our praise, for each has performed an indispensable part.

The Chicago Electrical Association, which meets on the second and fourth Tuesdays of each month at 913 Masonic Temple, has elected the following officers for the ensuing year: President, Albert Scheible; vice-president, W. D. Ray; secretary, H. G. Dimick; treasurer, F. S. Hickok; librarian, E. F. Norton.

Questions and Answers.

BY OUR "QUESTION EDITOR."

ELECTRIC VS. STEAM TRUNK LINES.

To the Editor of Electrical Review:

In the first annual report of the Commissioner of Labor, Col. Wright made a strong point in reference to the effect of machinery on industrial conditions by showing how much it would cost to have men and horses do the work now done by locomotives. He put the cost of operating the railroads of the country with steam power at that time, 1886, at $502,600,000 a year, and said that with men and horses it would cost $11,308,500,000. I want to use the point in an address I am preparing, and to add an estimate of the saving that will come when the same work is done by electricity instead of by steam. Some years ago I saw an estimate that electricity will reduce the cost one-half, but I have seen no estimate since the considerable application of electricity to street lines has given a better basis for prediction. Can you enlighten me without too much trouble as to what is the present expectation of electricians on this point? Very truly yours,

Boston, January 11, 1894. R. L.

1. The estimated cost of operating the steam railroads in 1886 is believed to be approximately correct. A few millions either way in such a total would cut no figure.

2. The deduced estimate that with men and horses it would have cost $11,308,500,000, is not far wrong. It represents 22½ times the cost by steam, and if one takes into account at least two shifts of men and six shifts of horses daily, and figures the wages, feed and attendance, wear and tear, and all other items involved, the above multiplier can hardly be far astray. If anything it is too small.

3. It is so doubtful if electricity will, for many years yet, be capable of taking the place of the steam locomotive, that an estimate made now would be of little or no value. The locomotive itself is constantly being improved, little by little, stationary steam plants are undergoing rapid changes, and there is no estimating on what they may be a quarter of a century hence. If the application of electricity were to-day demonstrable, as less expensive than locomotive haulage on trunk lines and branches, it yet would be many years before any great substitution would take place. A general change would involve the wiping out of an enormous amount of capital now invested in steam locomotives, with practically no return except the prospective reduction of operating expenses. As things stand to-day on the average steam railroad, the reduction of operating expenses would be comparatively trifling, being confined chiefly to the saving of fuel. On the other hand, the interest on the additional capital required for the change to electricity would for a long series of years more than eat up any possible saving in operating expenses. We see no hope in the near future for the general substitution of electricity for steam on our trunk lines and branches. Inter-urban electric roads will be built for passenger and freight traffic; but beyond the local business they will be but feeders and distributors for existing steam roads.

The change from horse to steam was a natural one. A single steam locomotive manned by two men can do the work of hundreds of horses; but we are then down to the standard limit of power, and a steam locomotive of a given number of units can do just the same work as an electric motor of the same number of units. A horse-power is the same whether expended by a steam piston crank and wheel, or by an electric armature, shaft and pinion. Were we able to so get the electricity as to avoid the tremendous losses of conversion between the coal-pile and the piston, it might be a more hopeful outlook. But as there is nothing in sight in that direction, we think it might be wiser to avoid any such prophecy as you think of announcing.

FINE ELECTROPLATING.

To the Editor of Electrical Review:

I have lately seen some very beautiful specimens of the electroplater's art. A friend of mine showed me some quaint Brazilian insects, dead of course, and apparently made of polished gold. Would you kindly tell me through the colums of your valued paper how this was accomplished? Every hair and joint was perfectly reproduced. It would seem to me impossible to make a casting of this and reproduce it exactly that way, so I presume it must have been electroplated directly.

New York, Feb. 1. N. U. M.

The process you speak of is indeed a very beautiful one, and it is considered a *chef d'ouvre* of the electroplater's art. The insect is coated directly by immersion into a bath. A conducting surface must first be placed upon the insect, and therein lies the difficulty. Several people have tried with varying results, but the writer has successfully accomplished this in different ways. The process, as usually recommended in the text books, is as follows: Make a saturated solution of phosphorous in bi-sulphide of carbon, and into this dip the insect until no air bubbles are left. In case air bubbles should stick they may be brushed off with a glass rod. Remove the insect and allow nearly all of the solvent to evaporate. This leaves a film of phosphorous which serves as a conductor. Wires, of course, must be attached before immersion into the solution. This is not a safe process and we would not advise it, because the phosphorous being left in a finely divided condition is liable to spontaneous combustion, thereby setting the insect on fire; besides a drop of this liquid spilled on the carpet would very likely cause a conflagration. It is much better to immerse the insect already suspended by fine copper wires into a solution used for silvering purposes. This silvering process may be accomplished according to any of the good recipes used by glass silverers or mirror makers. A film of silver is thus readily made to adhere and become a perfect conducting surface. In order to electroplate it, it is advisable to coat it first with copper, using a very weak current, thereby ensuring an even deposition. After a sufficient thickness of copper has been obtained, it may be dipped for a moment into a gold solution, when it thus becomes a very pretty curio or ornament.

A Letter of Inquiry on Tariff Rates.

The Hon. D. W. Voorhees has sent to the Electrical Review a copy of the following letter of inquiry on the subject of tariff rates and depression in trade. The letter is issued by the Committee of Finance of the United States Senate, of which Mr. Voorhees is chairman. It is requested that persons interested make a reply directly to the committee:

In former years, when the question of tariff was uppermost in the consideration of the people, circular letters were addressed to merchants, manufacturers and producers, representing the industrial elements of the community, and others, making inquiries as to the character and amount of their output, the capital invested, prices, wages, rates of import duties, etc. This was notably the case in 1845, under the direction of Secretary Walker; in 1882, through the Tariff Commission; and in 1885, under the direction of Secretary Manning.

The replies to such interrogatories furnish valuable statistics and other data, and materially aid in legislating upon the subject of customs duties.

With a view to securing such information, the Committee on Finance submit to you the following questions, which they trust you will formulate replies to, adding such general or special matter as you may be possessed of, and which, in your judgment, will be of value to the committee:

1. State name of corporation, firm or individual and character of manufacture?
2. State location of plant?
3. What amount of capital is invested?
4. When was the industry established?
5. State the amount of production, kinds and value of articles manufactured annually since the establishment of your industry: Description, value and quantity for each year?
6. Have you at any time during the past two years been running less than full time, and if so, when and why?
7. What rate of *ad valorem* (or specific) duty is necessary to place domestic products on an equal footing with foreign producers and your reasons why?
8. If the rate of duty upon your class of manufactures were reduced one-third, what reduction in cost of production would be necessary?
9. Please state the domestic wholesale price of your goods in 1884, 1890 and 1892, and at the date of your answer?
10. To your knowledge has there been an increased competition in your line of manufactures, either foreign or domestic, during the past four years?
11. Do you desire a specific or an *ad valorem* duty, and why?
12. Are you manufacturing or producing as many goods or commodities as you were in 1892, and if not, why not?
13. What has been the tendency of wages during the past 12 months?
14. If possible will you give an estimate of the exact cost of living of the families of two or more of your skilled workmen, specifying as near as may be items of expenditure?
15. Have you any difficulty in construing the existing law in regard to importations of the class of articles you produce, and have you any suggestions to make?

Bell Magneto Telephones For Sale.

The Metropolitan Telephone and Telegraph Company, 18 Cortlandt street, New York, and the New York and New Jersey Telephone Company, 16 Smith street, Brooklyn, N. Y., are offering for sale Bell magneto telephones at $1.75 each. Magneto calling bells are furnished at $3.75 each, and connecting cords, with which to attach the hand 'phone to the magneto, are supplied at 25 cents each. Apparatus for a private line, without the wire, including two hand 'phones, two magnetos and two connecting cords, may thus be purchased for $11.50.

The first purchase of a receiver was made by Mr. U. N. Bethell, general manager of the Metropolitan Telephone and Telegraph Company, soon after the patent expired. It cost him $2.50, but about the middle of last week the price was reduced to $1.75.

Herbert Laws Webb, one of the officials in Mr. Bethell's office, was asked what effect the expiration of the patent would have on the public.

"Anybody," he said, "can buy receivers now, and if he likes can put up a private wire between rooms in his house, or between his house and office or his office and stable, or between his own house and that of a friend. We virtually establish a new branch of our service in being enabled to put these receivers on sale. Doubtless a good many of these short private lines will be put in, though probably one phase of the service, as I have seen it in Spain, will never become popular here.

"There, as you know, a young lady must be under surveillance when she sees her lover. So the custom has arisen between lovers of talking through the telephone. The lover stands in the street with a receiver at his ear, while his sweetheart talks to him from the other end of the wire in the second, third or fourth story window, as the case may be."

Mr. Webb said that the expiration of the patent would not materially affect the service in this city. Many manufacturers of electric appliances announced that they would be able to supply telephones on and after February 1. That will not make much difference to the telephone company, Mr. Webb thinks. It is not the getting of the telephone instruments that is the important thing, he says, but the advantage of being connected with a system which can afford an extended service. Gen. C. H. Barney, who is well known to the electrical fraternity, is in charge of the sales department of the Metropolitan Telephone and Telegraph Company at 18 Cortlandt street, New York.

An Automatic Stopping Device for Street Cars.

The first step in the improvement of any combination is the elimination of the uncertain human factor. In the improvement of the method of operating cars upon crowded streets so as to avoid accident, the public is not the element to be eliminated, certainly. While the public will benefit by education, yet many injuries result from a lack of presence of mind on part of the motorman, and a lack of adequate means of doing what should be done instantly and effectually.

The motorman can be "eliminated" so far as accident is concerned, only by some mechanical device which will automatically and at the proper time do all that the motorman can do—stop the car.

Such a device should cut off the source of power which propels the car, brake the car in the most effective manner and absolutely prevent anything from being crushed beneath the car. It should be simple in construction, always in working order and inexpensive. All of these various requirements it has been attempted to meet in the device described below.

This device is operated automatically by pressure upon a hinged projecting fender, or by the motorman at will. Either method moves the rod under the car platform, cuts off the current or releases the cable and swings the shoes down upon the track under the wheels, which run up slightly on the shoes, blocking the car. It is evidently impossible for anything to get under the wheels and it is equally evident that the car cannot be more effectually braked, practically, in any other manner, for the heavier the load, the more effective the braking, particularly, if the under surface of the shoe is slightly roughened, and for this purpose the shoe may preferably be constructed so that the roughened surface bears upon any desired part of the rail to prevent excessive wear. The shoes on either side of the car may be connected with a light wire fender, to keep anything from getting under the body of the car, or, if preferred, the usual board fender may be fastened directly upon the shoes.

The mechanism at the point directly under the front of the body of the car where the rod running from the hinged fender connects with the rod running to the shoes is a simple lever, for the purpose of obtaining greater movement, and of throwing the weight of the shoes upon a dead center, it being kept there by a slight spring. This arrangement keeps the shoes in their proper position when raised, offers a ready means of adjustment both as to movement of parts and delicacy of action, and prevents any operation except in the manner appointed.

The shoes may be lowered, as already stated, or raised by the motorman by means of the lever upon the platform. The handle of this lever is hinged so as to drop into a slot to prevent it being turned accidentally, and this does not interfere with the operation by the hinged fender automatically.

It is not claimed that each distinct part of this device is new. It was put forth simply as a combination of well-known mechanical devices, for the accomplishment of obvious purposes. It is effective, inexpensive, cannot get out of order, and is not cumbersome or unsightly. It is controlled by Mr. D. McFarlan Moore, electrical engineer for the General Electric Company.

The Walker Manufacturing Company.

The amount of business already brought to the offices of the Walker Manufacturing Company, of Cleveland, O., before a single machine has been offered for sale, is a gratifying evidence of the confidence displayed by railroad men in the ability of the company to furnish first-class dynamos and motors in every detail of construction.

Within the past two weeks the working force in their electrical department has been considerably augmented in view of the large amount of business now under consideration. In two instances of which we know, arrangements for heavy instalments are nearly complete, and preliminary work on these will doubtless be commenced within a very short time.

It is the intention to hurry all work forward with the utmost dispatch consistent with thorough attention to mechanical detail, and to this end the company is now preparing to materially increase its present forces early this month. Some of the improvements suggested and carried out, while in nowise a radical departure from existing types, have been found to effectually increase the output of the machines and give additional economy in construction. The armature winding of the motor possesses certain valuable innovations and improvements, tests upon it having recently brought forth the most gratifying results. The desire on the part of prospective railroad builders to place orders before a machine is actually on the market is almost without precedent among electrical companies. It is an indorsement, in fact, of past successes gained by the Walker Manufacturing Company in other lines, and is, furthermore, an earnest of the confidence felt in the ability of the gentlemen they have so recently associated with them in their electrical engineering department.

Less than two months ago the details of construction were begun, yet within this time what has easily been accomplished would have taxed to the utmost the resources of almost any other company engaged in the manufacture of a new branch of industry. It is just such activity which serves materially to insure the confidence of the commercial world and bring business unsolicited, where otherwise it would be diverted to different channels. And, moreover, as a factor the well-known ability of a company to do rapid as well as satisfactory work is paramount where large contracts are at stake.

The officers of the Walker Manufacturing Company report that they are well pleased with the outlook for Spring business. The fact that an immense amount of capital is locked up awaiting investment, that a number of new roads are to be constructed, and that renewals on a large proportion of electric roads throughout the country will be necessary, causes them to assert with positiveness their expectation of having plenty to do from the inception of business.

The De Laval Steam Turbine.

One of the De Laval steam turbines, which created great interest at the World's Fair, has been on exhibition at Madrid, Spain, where it was shown working a dynamo.

The Trend of Electrical Investment.

READ BEFORE NORTHWESTERN ELECTRICAL ASSOCIATION, MILWAUKEE, JANUARY 18, BY H. C. THOM.

Electrical interests have been handicapped because commercial colleges and high institutions of learning have not incorporated in their curriculum, "How to become receivers."

The unparalleled business depression of 1893 has undoubtedly impressed professional men, who so well understand commercial problems in text books, that future courses of study will properly guard the needs of trade.

The pulse of the moneyed public beats high with the "oil fever." Hard earned dollars from the farms of Illinois and from the banks of New York, have rattled merrily *en route* to Oil Creek, dropping down the dark shaft with a gentle good-by forever. Crisp certificates from mortgages and bonds fluttered about the skeleton derricks and circled downward from human sight with a melancholy sweep. The poor who came back from the Pennsylvania pilgrimage could quell a riot at Bay View or carry Ohio for the Democratic Party.

I have a friend who tenderly took a small bottle from his desk one day with the remark "That cost me $17,500; 'tis a legacy for my children." The label was turned for me to read. "Crude oil, 1864." What a story was implied in that simple symbol. A house that is built, finished in and out from corner-stone to attic gable, speaks of work day and night; speaks of struggles by father and mother; speaks of sacrifice and long waiting, of disappointment and triumph, of hope and consummation, of purpose immutable and completion ideal. But when a home is in ruin, when toppling walls and blackened rafters meet the eye of the builder, then the lesson comes home. "Crude oil, 1864."

In 1849 the rosy sunrise of the East was lost in the yellow glimmer of the West. Home was dull and dreary, earnings seemed small, the meadow yield was light, and it was said that gold could be had for stooping.

FIG. 2.—BOTTOM FLANGE FOR EDISON OR SAWYER-MAN NECKS.

FIG. 3.—SPRING NECK FOR SAWYER-MAN LAMP.

The cap, the apron, the plane, the plow, the pen, the forge, the bank, the office and the class-room were left unlocked and unguarded. A meandering and untraveled trail and a picked white bone of a finger from a dead hand are the silent signboards that mark the path of the "Gold finder." Nearly every county in the States has many men who have in their skeleton closets skeleton bottles labeled "Crude oil, 1849." 'Tis a restless habitant of the old home and bold. It walks forth every night when old friends meet and on dreary days when the hand and brain are idle.

The phantom dreams of sudden riches, how real they are. The mirage of hope dances before our eyes, and while we look intently judgment creeps silently away and dies from neglect. The days of 1849 and 1864 are times of history to most of us. We read of them with the same interest that we do of Washington's Winter at Valley Forge. Application to the conduct of present affairs is rarely made and we unthinkingly go on plowing green sward without knowing what the harvest will be. I am of the opinion that more skeleton "crude oil" bottles for 1893 and 1894 are being blown to-day in the electrical field than were molded in 1849 and 1864. It is but a little time since the Wizard hung a lamp in Menlo Park, and but a little time since "trolley" was coined fresh and bright from the mint of language.

Corporation after corporation, company after company, limited and unlimited, have knocked urgently at the door of Secretaries of State for franchises and privileges. Uncounted millions have sought investment in generators, dynamos, copper wire and T rails. Lawyers can be found who, upon becoming students in foreign tongues, could draft organization articles and set the new enterprise in legal motion. We are upon the highest point of the grade. Everything is ready. Engines puff impatiently, and their shoulders tremble in anxious strength for the load. The station is a picture of glittering marble, burnished brass and polished steel. The boilers with their red glow are ready to send leaping energy through the labyrinth of intricate wires. The track leads here and there through the main thoroughfares, with its arm of iron bolted to the solid earth.

Switches and curves, spurs and side tracks are masterpieces of mechanical skill. The car, "a thing of beauty and a joy forever," stands ready for her life race. The signal is given. The steady hand of a brotherhood engineer is upon the lever. The wheels move as he knew they would, for he knows the truth and he is master. The motorneer comes from a distant city. He has experience. He is careful, alert and sober. With hand upon controller and brake, with steady eye upon the grade he hears the two bells. A slight movement and the descent begins. With infinite care he safely delivers his precious freight of enthusiastic men and lovely women at the end of the journey. Day after day, month after month, this goes on in sunshine and storm, in mud and sleet, in heat and cold the faithful employee runs on scheduled time. The engine may break down in harness but a substitute is ready. Supply men tell us that there is nothing like having a reserve and so we buy. An armature may short-circuit and burn, another takes its place. Nothing seems impossible. Supply houses love the public and are, therefore, constantly alert to replace any broken machinery at a moment's notice and at bed rock figures so that the dear people shall not walk. The conductor and his little nickel box reports at the office the number who have ridden who have no passes. Everything is lovely. Of course, the road is a success. The public claps its approving hands. "What a splendid thing for our city." A year rolls round, a common stockholder who has but little business to talk anyway, but who earned the $20,000 he put in by hard knocks, inquires at a regular annual meeting what dividend he is going to get on his $20,000. "The idea, I always heard he was an awful close man. Why, my dear, this is the end of the first year's business. We expected to lose money the first year. We are going to

FIG. 1.—STIRN'S UNIVERSAL ELECTRIC PULL SOCKET.

increase our capital $100,000. What for? Why, bless you, if we run twice as many cars we will get three times as much travel. How do we know? Don't you understand that if you embark in electrical business you must have faith?" The old man speaks again. "If we lose money on a capital of $100,000 how do you expect to make money on a capital of $200,000?" "What impracticable ideas the old man has. I don't think he is a very good business man anyway. By increased travel, can't you see?" "Yes, I suppose so," the old man reluctantly admits. When it comes to increasing the stock the old man has to stand in and take $10,000 additional stock.

At the second annual meeting the books show that the additional capital stock has been expended in construction and equipment and the concern has a floating debt of $21,000. The old man is getting nervous. Reports from the superintendent show that the boilers are out of repair. Three new arches must be put in. The condenser was never a good one. Not the right make. We ought to have a new one. The motors are not large enough to carry trailers. Besides they are making a new armature now that can be rewound at the station. Unless certain changes are made at the power house insurance rates will go up 45 per cent. "How much will this cost?" timidly inquires the old man. "I haven't looked that up yet," says the manager. "How are you going to pay our debts and make all these changes?" says the old man. The answer was ready: "Why, bond the plant, of course. Nearly every one is doing that nowadays." In his mind's eye the old man sees the bondholder swooping down on his little $20,000 like a fish eagle on an innocent perch. He is getting desperate.

"I'll not consent to bond it." "Very well sir, then the stockholders must give an individual note to raise the money to pay off the floating debt and make the necessary changes." The old man says in a sad voice, "I'm afraid that this won't pay 25 per cent. as I thought it would when I put in my money." An idea comes to the old man. "How much does it cost to get one horse power out of lighting for one hour?" The manager and the superintendent look at the old man in silent pity. But the old man is morbidly set on this matter and insists on an answer. "Of course you won't understand, but 746 watts represent one horse-power of energy. Now, if coal costs $1.50 at the mines and labor is $1.75 per day, and—" the old man silently steals away, walks over to his lawyer's office and deeds the house and lot to his wife.

This imaginary situation will find many whose relations are so closely identical, in fact, that they will secretly hug it to their hearts and call it all their own. The illustration is no more applicable to street railways than to central lighting stations. The engineer, the motorneer, the lineman, the everything that is the vein, the circulation of a plant may be all right, but until we can figure and estimate and know the truth of the cost of operation and conduct of our business, there is a leak in the main artery that eventually drains life away. An incandescent lamp is a beautiful thing. An arc light that does not sizzle is an eternal glory to the intelligence of men. An electric railway is a splendid thing for the public and to land improvement companies, but unless they can be maintained at a net profit, before many days the fatal bottle of "Crude electricity" will adorn the mantel of many humble homes.

The conductor can turn in no more nickels than he receives. The collector for a central station brings in an amount that equals the bills and no more. Electricity is not to blame if the amounts are less than the cost of the service. Somebody's head needs fixing. Is it possible that philanthropists control 80 per cent. of the electrical plants in this country? Do you know that but 20 per cent. of the lighting stations of the United States return four and one-half per cent. upon investment? Then it must follow that the 80 per cent. is busily engaged in blowing bottles. Ten years ago capital lost

FIG. 4.—SCREW NECK FOR EDISON LAMP.

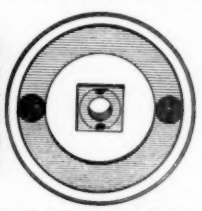


FIG. 5.—BASE OF SOCKET FITTING THOMSON-HOUSTON LAMP.

its reputation and eagerly jumped at everything electrical. The glamor and the haze that clouded the eye of the capitalist is drifting away. Investors are in the hands of receivers We must wake and profit by experience that has been so dearly bought by others. It is not my purpose to weary you with figures. What I am to do is to bring to your mind so sharply and so clearly the indisputable fact that we are hoping for profits in the far future, and that these hopes are based upon conjecture and guesses. It is infinitely better to do no business at all than to do a large business at a loss. We may as well be brave and look the situation squarely in the face. The public thinks we are coining money. We have the name, but not the gain. We do not murmur because the money comes from men who have other interests to protect, and they bury their loss so deeply that the world can never know. Eighty per cent. of the people who grumble at the monthly bill have been given service at such a rate as to entail a loss upon the company they patronize. How long can this continue? Men who have kept steady in faith for years will falter by and by. Stock will be sold for what it will bring, and the weary burden laid down. The impetus of gold mining received a deadly shock because so many claims did not pan. Electrical development must suffer if holders of stock are too often pinched.

Electricity is a quick friend, an obedient servant and an insidious power for good or evil. Good, if well managed; evil, if guided by ignorance. If generated for less than 17 per cent. net profit (10 per cent. for depreciation and seven per cent. on the investment) it will ruin homes and devastate the fertile field of research and progress. Electrical investigation has called out the highest talent known to the mechanical and inventive world. Let this talent be seconded by the same type of business sagacity, and progress will be unrestricted, the confidence of capital will be restored and fewer men will walk the floor far into the night, the morning sun will shine in the windows of happy and prosperous homes. The public is willing to pay living rates. That we have not charged them is no fault of it. At the same time corporations have no moral right to so conduct business that the effect of ignorance and mismanagement falls upon our necessary friend the customer. I most earnestly trust that this paper will start a movement which looks toward the establishment of rates that will be just to the public and remunerative to corporations; that will strengthen the heart of the student; encourage research and secure the eternal friendship of the capitalist. If this be done bottles for "Crude electricity" will be a drug in the market.

Stirn's Universal Electric Pull Socket.

The Universal Electric Pull Socket Company, 27 Beaver street, New York, has just put on the market an improved form of Stirn's universal pull socket which is illustrated in Fig. 1. The shaft to which the pulling lever is attached has an octagonal head, and by loosening the screw and washer the lever may be shifted so as to be operative in whatever position the socket may be placed. This flexibility of arrangement makes it possible to project the socket downward, upward, laterally or at an angle between these positions.

For the Thomson-Houston lamp no adjustment of the socket is required, and all that is necessary is to screw the central split-screw of the socket into the screw-hole in the foot of the Thomson-Houston lamp, whereby the lamp is held securely and the proper connection made.

For the Edison lamp the screw-neck must be inserted into the socket. The two opposite screws in the bottom of the top cavity of the socket are slightly loosened and then the screw-neck is inserted in such a manner that the heads of the screws can pass through the diametrically-opposite notches in the bottom flange of the screw-neck, and the screw-neck is then given a quarter turn on its longitudinal axis, so as to cause the two hook-prongs to pass under the heads of the screws. The screws are then drawn up tight, and the screw-neck is held securely in the bottom of the socket. All that is necessary is to screw the Edison lamp into it, and the lamp is held securely and the proper connection made.

For the Sawyer-Man lamp the longitudinally-cut spring neck is used and is inserted and fastened in the same manner as the screw-neck for the Edison lamp. The Sawyer-Man lamp is then inserted and is held by the several prongs of the split spring-neck, the pin on the foot of the Sawyer-Man lamp passing into the split hollow screw in the universal socket.

In all cases it is only necessary to pull down on the cord or chain to make or break the circuit—that is, to light or extinguish the lamp. The cord or chain after having been pulled always returns automatically to its original position.

The advantages claimed for this device are that the user is not dependent on one particular style of lamp, but may burn any lamp having an Edison, Thomson-Houston or Sawyer-Man base; no step-ladders are required to light or extinguish the lamp; the sockets may be used on a chandelier and the wall switch be done away with. A luminous ball may be attached to the pendent chain at its lower end and thus facilitate turning on the light when in a dark room.

A Heroic Experiment.

In 1864 Tyndall performed the experiment of separating light from heat. In the course of the investigations which enabled him to do this he made one of the most daring experiments that ever a scientific man ventured on.

Knowing a layer of iodine placed before the eye intercepted the light, he determined to place his own eye in the focus of strong invisible rays. He knew that if in doing so the dark rays were absorbed in a high degree by the humors of the eye, the albumen of the humors might coagulate; and, on the other hand, if there was no high absorption the rays might strike upon the retina with a force sufficient to destroy it. When he first brought his eye undefended near the dark focus the heat on the parts surrounding the pupil was too intense to be endured. He therefore made an aperture in the plate of the metal, and, placing his eye behind this aperture, he gradually approached the point of convergence of the invisible rays. First the pupil and next the retina were placed in the focus without any sensible damage. Immediately afterward a sheet of platinum foil placed in the position which the retina had occupied became red hot.—*Exchange.*

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This will be a great year electrically. Mark it.

The wise manufacturer is the one who manufactures. Take a little chance yourself. This is a great and glorious country and bound to prosper.

The death of Geo. W. Childs takes from the world one of its noblest natures, and from journalism one of its most highly esteemed and universally respected members.

It is very gratifying to hear from our foreign friends. We are daily in receipt of letters in praise of the ELECTRICAL REVIEW. A recent communication speaks of "the comprehensiveness of all its technical articles," and recommends it to all students in the science. Another European correspondent states that a friend in the East advises him to read the ELECTRICAL REVIEW for the latest electrical news printed in the most cheerful and interesting manner. And still we are not proud.

THE TELEPHONE SITUATION.

Loud and earnest and multitudinous cries for information on the telephone situation come to the ELECTRICAL REVIEW from all parts of the United States. It would almost seem that the hard-pressed public expect the expiration of Bell's receiver patent to cure the hard times.

The majority of inquiries indicate a sincere desire to learn what the writers may undertake without infringement—just how wide a field is opened by the patent that on January 30 became public property. That it is a fundamental one there can be no question; and to imagine that its owners during the 17 years of its life have not been providing for the situation of to-day would not be giving them credit for the sagacity that has marked their success in the past; yet the fact that one day they announce the sale outright of magneto telephones, commonly known as "receivers," at $2.50 each, and two days later reduce the price to $1.75, displays an uncertainty that is difficult to explain.

Other interested parties write to ask what the course of the American Bell will be towards its licensees. The answer to this question we would suppose is to be found in the contracts made with the parent company, although there is reported a graded reduction in the perpetual royalty of $7 per annum heretofore exacted on every receiver. There is evidently a strong demand from the local companies that the royalty shall not be collected in any amount, notwithstanding the provisions of the agreement between licensee and licensor. This will not, however, cut much of a figure in the future of the telephone, except that the decision of the Bell people will retain or estrange most influential and experienced allies.

Just how far the new comers in the telephone field may go in the business of establishing exchange service depends very largely on the size of their bank accounts, ingenuity of their electricians and ability of management. This would be true in the case of paralelling a well-established railroad. The patent strength of the present company is still formidable, yet there are many independent valuable patents, and a wide field of usefulness for the telephone unoccupied. Legal and technical knowledge will be necessary to keep the new companies on safe non-infringing ground, the eager demands of the public will point the way to untilled soil, and experience only can teach how best to garner the harvest.

SHALL ELECTRIC ROAD BEDS BE TAXED.

To any one who has ever witnessed the work of construction, the laying of tracks, and all the elaborate and costly details attending the building of either a cable, a trolley or other electric roads, it would seem that the property thus occupied by the road would be just as liable for taxation as any other property owned by any other land owner. It is undoubtedly a fact that a work that costs so much money must be property of some sort, and if property, why not property of the same sort as anything else which is built on, upon or under ground. The structure of such roads is as solid almost as the streets themselves. It, therefore, would appear as natural to regard the road itself in the light of real estate as much so almost as the power houses of the company. The question which arises is whether or not the road bed of a line is taxable property.

It was popularly supposed that the Court of Appeals in the State of Maryland settled this question in the case of the Union Railroad, of Baltimore, in 1878. "In passing upon that question, however, it became necessary for the court to consider what was the precise nature and legal definition of the right of property possessed by a railroad company in its road bed and tracks generally, but more especially when constructed upon or under the public streets of the city. The court said: "The company had an easement in the way occupied by its road, and whether that easement be under or over the public street it is an element of value to the road, and as such should be included in the valuation of the road itself." Further on the court declares: "That an easement enjoyed in the bed of a public street may be assessed and taxed as real estate."

In the face of this decision it will prove interesting to know what stand the companies will take in this matter. If the property is taxable, then it would naturally follow that the net receipts of the car companies would materially diminish, unless means be provided whereby the rates of transportation may be correspondingly increased. The question is one, a settlement of which is awaited with interest.

Among the numerous telephone circulars that come in every mail to the REVIEW office, several of those relating to new exchanges claim that in their system there will be an entire absence of that frequent and unsatisfactory response, "They are busy." This is good news. Just how the system will prevent the subscriber wanted from talking at that moment to some one else previously connected is not explained. And to claim that the new class of subscribers will be of a kind that can talk to several parties at as many telephones at the same moment taxes our credulity. Still that is the only kind of a subscriber whose telephone need never be reported "busy."

Mr. Marsden J. Perry, former president of the National Electric Light Association and vice-president and general manager of the Narragansett Electric Lighting Company, of Providence, was recently appointed co-receiver with Hon. Thomas C. Platt, of New York, for the New England Railroad. Mr. Perry's great energy and ability make him particularly well fitted for the onerous duties of this position.

Mr. William Bracken is an able and experienced advocate of the storage battery, and it is through the work of such men that continued advances are made. His article on the storage battery, which we publish this week, will be read with interest; yet it does not assure us that the storage battery has been perfected for traction purposes. We still must wait.

February 27 is the date of the electric light convention, at Washington, D. C. The attendance promises to be particularly numerous. The ladies are going in numbers this time.

Capt. Edmund L. Zalinski, Fifth Artillery, of dynamite gun fame, has been placed on the retired list of the army.

A toll service is the correct solution of the telephone rental problem.

CORRESPONDENCE.

OUR BOSTON LETTER.

Work on the survey of the Hartford suburban electric street railway has already begun.

An Important Meeting of the stockholders of the United Electric Securities Company will be held in Portland, Me., on the 29th, at which the advisability of reducing the common stock, and the extent of such reduction, will be voted upon. It is also proposed to issue new common stock of the reduced par value, in order to mark down their assets from $1,000,000 to $500,000 in making up the annual report.

Currier, Mayo & Company is the title of the new firm which, on the first of the year, succeeded to the business of J. A. Grant & Company, 8 Olive street, Boston. Mr. Grant, while still retaining his interest in the concern, has retired from the active management, and the reins are now held by C. H. Currier. Mr. Currier is a young man of undoubted executive ability, and the business will certainly not fall behind under his efficient management.

An Electric Road between Athol and Orange, Mass., is under consideration, and will probably be put through some time during the coming Summer. An electric road between those points is badly needed, as, while they are only a few miles apart, the train service of the Fitchburg road is anything but good, and travel between the towns is limited. There are hundreds of towns throughout New England suffering from the same disadvantages, but the next few years will see a marked difference in the development of suburban roads.

The W. S. Hill Electric Company, of this city, have recently received one of the largest orders ever placed for special switches, in which line of work they have established an enviable reputation. The order includes switches of all sizes, ranging from 500 to 4,000 amperes, and calling for the highest grade of material and workmanship. Business with this concern is increasing so rapidly and holding up so well that their present plant, though greatly enlarged within the past year, is becoming entirely inadequate to their requirements, and they are seriously considering the necessity of building in the near future.

The Recent Decision of Judge Ricks, of the United States Circuit Court, of Ohio, in the case of the Buckeye Electric Company, has formed the chief topic of discussion in lamp circles during the past week. The ground taken in his decision being entirely new, and at this late stage of the proceedings, when every possible point of vantage has been so thoroughly discussed, has startled the trade not a little, and a good many people are putting on their thinking caps in an endeavor to find out why this view of the case was not touched upon before. If Judge Ricks' ruling is correct, and the general opinion seems to be that it is, it is a remarkably simple solution of the problem, and will, no doubt, have an important bearing on the cases recently decided and now pending in this section of the country. One prominent manufacturer here gives it, as his opinion to-day, that it would lead to all the lamp companies applying immediately for a dissolution of the injunction against them, and that one Connecticut concern had already taken steps in that direction. Whatever the outcome, it is certainly the most interesting factor that has entered into this controversy in some time, and will, undoubtedly, be the means of further stimulating the lamp industry.

Few People probably realize the vast amount of work done by the telephone companies within the past few years in the matter of putting wires underground. The New England Telephone and Telegraph Company have already expended nearly $1,000,000 in this work, and are constantly increasing its scope. In the City of Boston alone there are now 8,250 miles of wire underground, and it requires 1,051,271 feet of ducts to carry the various lines. The conduits require the greatest amount of care in construction, and the cement-lined iron pipes or "ducts," which contain the cables, are laid between successive layers of concrete, which entirely surrounds them. The greatest care must be exercised also in the construction and insulation of the cables themselves, to overcome the element of induction, one of the greatest obstacles encountered in underground work, and which for a long time seriously delayed its extension. The New England Telephone Company, in addition to the work done in Boston, where 80 per cent. of their wires are underground, have also been doing good work in Cambridge, Newton, Brookline, Lowell, Lawrence, Salem, Worcester, Springfield and Holyoke, and it is their intention, eventually, to have their entire system underground. H. G. T.

Boston, February 3.

OUR WESTERN LETTER.

Trolley Wires are among the deadliest of parallels, from the point of view of the editor of the Chicago *Tribune*.

Mr. Hugh G. Smiley is favoring his Chicago friends with the pleasure of his company. "Same old Smiley!"

Mr. George G. Carter's many friends will sympathize with him in the loss of his wife, who died on Saturday, February 3.

Mr. Fred. Horne returned on Wednesday from an Eastern trip, during which he arranged for the handling of the National apparatus in the East.

The Edward P. Allis Company is considering the advisability of dividing its big World's Fair engine into two engines, as there is but one offer for it in its present condition.

Prof. D. C. Jackson delivered a lecture on "The Competition between Steam and Electric Locomotion for use in Elevated Railway Service" before the Wisconsin Electric Club, in Milwaukee, January 19.

Mr. J. H. Gregg, of the Link-Belt Machinery Company, Chicago, is meeting with excellent success in securing orders for the Standard boilers, which have been referred to as "perfect steam generators."

Cushing & Morse, 225 Dearborn street, Chicago, the well-known pushers of Kerite, are sending to their friends a convenient little souvenir in the form of an aluminum quill pen-holder, having the good advice, "Be sure to specify Kerite," stamped on the feathery end.

Commutator Conserver.—The best-known commutator conserver on the market, and the one that has stood the longest tests, is Gale's, handled by the Central Electric Company, Chicago. Its excellent qualities have built up a steady demand from central station men.

Mr. W. H. McKinlock, president of the Metropolitan Electric Company, Chicago, returned from the East after securing the Western agency for a number of specialties, including the well-known P. & B. insulating compounds, armature varnish and insulating tape. The specialties will be pushed throughout the West and every effort made to impress users with their desirable qualities.

A Street Car Fare.—According to the attorney employed by the West Side cable lines, a nickel handed to the conductor does not purchase a ride but a contract to remain in the car till it reaches a given point. Therefore, if the cable breaks and the cars do not move, then the passenger is not only not entitled to the return of his nickel, but breaks faith with the cable company and forfeits his contract if he leaves the car and walks down town.

Rapid Transit.—The property owners out in Lake View are having a monkey and parrot time over the introduction of the trolley. Seven years ago they were offered the Van depoele system under especially favorable arrangements, but a few of the wealthy citizens having carriages objected, and thus for years the majority have patiently plodded home through the mud and slush. Last fall Mr. Louderback offered to extend his splendid equipment down Evanston avenue, but again the wealthy ones objected. Now, patience has ceased to be a virtue, the "down-trodden classes" are doing the objecting, and "general uproar prevails at the meetings."

Mr. John P. Barrett has returned from a trip to New York, Washington and other Eastern cities, and is quoted in the daily papers as being very favorably impressed with the excellent electrical and mechanical details of the Love conduit railway system as operated in Washington. On the telephone question he is reported to have said: "The Bell patents cover a large number of auxiliary devices, such as the carbon transmitter, the automatic arrangement for closing and opening the current through the local transmitter, and the universal switch board. All these are essential in the economical operation of large exchanges. The patent on the duplicate switch board has several years to run."

Municipal Control.—Some time ago Mr. Stead said: "What is more extraordinary to me is that you should not seem to have begun to take the necessary steps to acquire your tramways. The congestion of business in the center, and the distances which lie between the center of the city and the suburbs, make every line of street railway a gold mine, which in London we should certainly endeavor to secure for the people." It's bad form to mention Mr. Stead's name in society just at present, but his remarks appear to be bearing fruit, judging from the space devoted in a Sunday paper to a scheme by which the city may secure control of everything, including its Aldermen. Mr. Marcus Pollasky is the promoter of a scheme to build an elevated road on the North Side and let the municipality participate in the profits, *after* the bondholders are taken care of. As the cable roads now secure all the profitable traffic—that is, the short-haul passengers—the "L" would have to depend on its long distance traffic, and just where any excessive returns would come in does not appear at first sight.

Mr. Franklin S. Terry has severed his connection with the Ansonia Electric Company and accepted the appointment of secretary of the Sunbeam Lamp Manufacturing Company. For 10 years Mr. Terry has been a leader among supply men, has originated and introduced many progressive ideas, revolutionized the old method of cataloguing goods, and watched the business of the Electrical Supply Company, of Chicago, grow in magnitude under his fostering care, till it became one of the largest of its kind in the world. Mr. Terry's connection with the Electrical upply Company dates back to its organization in 1880, in Ansonia, Conn., when he was the only employé and attended to correspondence, bookkeeping and all other details. In the Winter of 1884-85, while hardly out of his teens, he opened a western branch, renting a portion of the second floor of 171 Lake street, and from that branch Mr. Terry built up the well-known Electrical Supply Company, of Chicago. How rapidly this business grew, necessitating the renting of the double floor at 171 and 173 Lake street, and then a removal to 171 Randolph street, and later the rental of two storehouses, and finally the leasing of the large salesroom and warehouse corner of Michigan avenue and Randolph street, and employing a hundred assistants, is well known to all. During this period Mr. Terry has been connected with the formation of several electrical associations, was one of the charter members and for five years the treasurer of the Chicago Electric Club, and it was in his offices that much of the preliminary work was done that resulted in the formation of the National Electric Light Association, called into existence by an editorial in the ELECTRICAL REVIEW.

Chicago, February 3. F. DE L.

OBITUARY.

Hassan H. Wheeler, president of the American District Telegraph Company in Brooklyn, N. Y., died on February 2, of hasty consumption, at his home, 241 Cumberland street. He was in his 56th year. In 1878 he went to Brooklyn and organized the American District Telegraph Company, and continued as its president until the end of his life. He leaves a widow and one son.

Wall Street and the Electrical Stock Market.

In the electrical list nothing of importance transpired. As has been the case the preceding week, Western Union and General Electric were more or less active. The former reached its lowest point on Monday, namely, 83¼. It seemed to have support around 84, and it ranged slightly above that figure during the balance of the week. There is no doubt but what there has been some selling of long stock on the idea that earnings would be very bad for the current quarter, and that the proposed increase in the capital stock of the American Bell Telephone Company was for the purpose of organizing an opposition to Western Union. It is said that long distance telephoning has not proved a profitable experiment, and that the company, in order to realize on its investment, will eventually adopt the system of sending messages by telegraph to a distributing point and then transmitting them by telephone, doing away with the cost of delivery which is a considerable item. It is stated that there are 12 long distance telephone wires in operation between Chicago and New York. A half a dozen stock houses have dropped Western Union wires and taken long distance wires. The effect of this upon Western Union is apparent.

An important decision was rendered by the United States Court of Appeals this week which overruled the decision of the lower court, which decided that the Western Union control of telegraph lines along Union Pacific was illegal, and that all telegraph companies had equal rights on the line.

All things considered Wall street is bearish on Western Union, and the belief is that should the support which is now extended around 84 be withdrawn, the stock would have a sharp drop.

General Electric fluctuated within a narrow range, it being from 33¼ on Monday to 35⅛, with closing prices at 34½ to 34¾. The transactions, comparatively speaking, were limited. There was considerable stock sold on Monday on the idea that Electrician Thomson would lead an opposition company, official denials to the contrary notwithstanding. The Schenectady executive force is now in full working order and the Edison building on Broad street has a deserted appearance. The debenture 5 per cent. bonds showed some weakness, selling down on limited transactions from 73 to 72. The preferred stock sold on the Boston exchange at 60.

The Edison Electric Illuminating, of New York, first 5's were in some little demand at 105 to 105⅛. There was no transactions in the stock.

The North American Company developed some little activity between 4 and 4¼. This company owns the Milwaukee Street Railway Company, which is its chief asset. The company has filed a second mortgage of $1,300,000 on its property. The first mortgage is for $10,000,000.

American Telegraph and Cable sold at 88½, and American District Telegraph at 40.

New England Telephone was quoted in Boston at 50 to 52; Erie Telephone 42½ to 43, being strong at the close Fort Wayne Electric was bid 31½ and held at 41½. Westinghouse Electric, first preferred, was bid 45½ and held at 46¼. The asset ting was bid 25½ and held at 26.

PERSONAL.

Mr. E. L. Babcock, of the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio, was in New York last week.

Mr. S. G. Booker, general manager of the Fidelity Carbon Manufacturing Company, St. Louis, is visiting New York.

Mr. E. L. Draffen, recently of the General Electric Company, is now connected with the New York Equipment Company.

Mr. Wm. S. Hine, president of the Wallace Electric Company, 104 Michigan Avenue, Chicago, was in New York last week.

Mr. Henry Hine, general manager of the Stanley Electric Manufacturing Company, Pittsfield, Mass., is convalescing from the grip at Old Point Comfort.

It is reported that Mr. R. H. Pierce, of Chicago, who is well known as the electrical engineer for the World's Fair Department of Electricity, has fallen heir to $200,000.

The Hon. William Ewart Gladstone, the great English statesman, has a relative in the electrical business in this city. Mr. I. W. Gladstone, at the head of the Edison Manufacturing Company, at 110 West Twenty-third street, is a distant cousin of the great commoner.

Mr. Geo. A. McKinlock, president of the Central Electric Company, Chicago, was in New York last week conferring with President E. H. Johnson and General Manager Little, of the Interior Conduit and Insulation Company, whose Western business is handled by the Central Electric Company.

Alternating Dynamos and Motors and Transformers.

A LECTURE DELIVERED BY DR. LOUIS BELL AT COOPER UNION, JANUARY 22, 1893.

Mr. Stanley is unfortunately not in the best of health, and only the latter part of last week he asked me to take his place this evening, which, for his sake, I was glad to do, although I naturally hesitate in lecturing on an important topic upon what is really very short notice.

It is a very singular thing that the alternating current did not come into prominence long before it did. The fact is that its discovery, if you please, was almost synchronous with the discovery of magneto-electric induction and the production of the first dynamo. It is now 63 years and a little over since Faraday produced the first dynamo, and a very crude affair it was.

It consisted simply of a wheel of conducting material, with a horseshoe magnet so related to it that the wheel revolved between the poles of the magnet. One contact was placed on the periphery of the disk; the other, attached to the axle, a minute electromotive force, according to our modern notions, was developed between periphery and center, and the resulting current could be utilized. This was the first dynamo, produced in 1831 (not so very long ago, after all), in a marvelously short time, considering the advances that have been made—a time so short that it is spanned by the lifetime of more than one of those whom I see before me, and by the working years of at least one venerable electrician, who is now in this audience. It was only the next year that the alternating current dynamo, in its first crude and rudimentary form, appeared. But before saying much about the alternating current, I would like to call attention to some of the salient differences in the point of view which we have to adopt when looking at direct and at alternating currents.

When Faraday performed the experiments that resulted in a dynamo, all that was known of electricity in practice had been obtained through the medium of the primary battery producing a direct current. The quarter of a century that preceded Faraday had been rich in experiments on a small scale, and the character of these, being performed with batteries only, somehow limited the range of the imagination when the new phenomena of magneto-electric induction were brought to public notice. So it was a long time before the alternating dynamo amounted to anything. So long as we are dealing with direct currents it is comparatively simple working. To use the old familiar analogy, we may look at a direct current, in at least many of its functions, almost as if electricity were a real fluid, and the wire a pipe. But just as soon as we leave the steady flow of the direct current and begin to think of its starting and stopping, or even more, when we are dealing with alternating currents, this conception of electric current becomes extraordinarily crude, and not only liable but certain to lead to very erroneous conclusions. So far from passing through the wire as water passes through a pipe, when we are dealing with alternating currents we almost have to abandon the wire. The energy shows itself in very large measure outside; in fact, instead of the electric fluid that the electricians of the earlier part of this century talked about so glibly flowing through the wire and delivering energy through it, in dealing with alternating currents we have to consider most of the energy that shows up in the wire at all as lost energy. The active part of the medium is that outside the wire and not inside it. This is true even of direct current in many of its functions.

I do not know any simpler or more effective way of illustrating this than by calling to your attention the marvelous rapidity with which a watch can be "queered" if you get too near a big dynamo. The magnetism does not confine itself to the dynamo—at least, not with anything like the strictness we would wish. On the contrary, it gets around over everything in the vicinity, and the watch is the sufferer. So with alternating currents the wire carrying the alternating current is only the center of an electrical disturbance that reaches out and on, producing effects on every conducting body in the vicinity. In fact, there may be circumstances under which the current will flow almost entirely outside of the wire, in which it will only be conducted along the merest skin on the outside. I call attention to this difference of point of view that we must adopt—the passage from the thought of electricity in the wire to electricity outside it—because, in dealing with all our alternating current phenomena, it is the latter view which we must constantly keep in mind. In fact the salient advantage of the alternating current is the potency of its inductive effects, the effects produced, not in the wire leading the current, but in the immediate vicinity of that wire; and so, too, we have to modify somewhat our hypothesis as to what this thing which we call electrical energy may be. I say electrical energy advisedly, because of electricity as such we know singularly little. We cannot experiment with it directly, for the very good reason that it requires energy to operate all our experimental devices; so that in every case we are dealing in a measure with electrical energy and can only separate from it what we may be pleased to call electricity in various roundabout ways and by various mathematical processes. To all intents and purposes we have, in modern electricity, electrical energy, and we say it equals electro-motive force multiplied by current; and so it does. In other words we find that we can correctly measure electrical energy by the available electro-motive force multiplied by the available current. I say this with some qualification, because in alternating current work the active electro-motive force and the active current are not always quite the same as in direct current work. What we deal with almost thoroughout the subject is the electrical energy, and we find, as the result of a great deal of study, that we may consider it as split up into two factors—electricity, current that is, and voltage—electro-motive force. What the physical interpretation of those two factors may be, or whether some other factors might not answer the purpose of physical interpretation quite as well, or indeed much better, we are not altogether prepared to say.

With this preliminary warning as to the radically different point of view which we must take in approaching the subject of alternating currents, I will revert again to the early alternating dynamo.

The fundamental principle of every dynamo is that when a loop of wire is thrown into or through a magnetic field, such as is produced in the case shown, by a large horseshoe magnet of hardened steel and a permanent magnet in the case of all the early machines and nearly all the medical batteries, this magnetic field has the property of generating current in a loop of wire that is moving with respect to it. All this is too elementary to dwell much on, except to point out that following the inexorable law which governs natural forces, which governs all the universe so far as we can find out, you do not get anything without paying for it. In other words, if you generate current by thrusting a loop of wire into a magnetic field the loop moves harder on that account; you do work upon it and get back that work or nearly all of it in current.

Now the first dynamo consisted simply of a horseshoe magnet having, we may suppose, the south pole *here* and the north pole *here*. (Pointing to sketch.) Right in front of it is a short horseshoe-shaped piece of iron with a wire bobbin wound on each end of it. These coils were connected in series, and what current could be obtained from them was taken off by a couple of collecting rings, one attached to each terminal of the wire. Now the mechanism of the dynamo was very simple. I have shown an elementary crank here, which in all practical cases is a gear or belt wheel so that we may obtain a higher speed. We have now two coils of wire here shown, opposite south and north poles respectively. As the lower part of the dynamo, its armature in our modern notation, is turned, each of these coils is thrust into the field produced by the magnet, completing what we now call the magnetic circuit, and then thrust out of the field. As one coil approaches a south pole, the other approaches a north pole, and it is wound in such a direction that the current from each flows in the same direction. Then as the poles are passed the coil which was before approaching the north pole has passed by it and begins to approach the south pole; the current in the coils is reversed, flowing smoothly in the opposite direction up to a maximum electro-motive force as the rate at which the wire cuts through the field increases, and then dying away again, giving a wave of electro-motive force something like this, which is what we now know as a sinusoidal wave, taking the shape it does because the coils are moving at a uniform rate of rotation. We, therefore, are dealing here with something totally different from the ordinary smooth continuous current. Instead of a uniform current, flowing under the pressure of a uniform electro-motive force, we have a current that rises to a maximum, dies away, starts in the opposite direction, rises to a maximum again, dies away, and so the cycle is completed. We call a cycle the complete wave from A to B; in other words, from the rise of the current in a given direction to its next succeeding rise in the same direction.

This, then, is the sort of current which we get from the very rudimentary dynamo here shown. And, curiously enough, we have to regard the commutator and the direct-current dynamo as a sort of afterthought. Scarcely had this device been invented before the mind of the inventor was put on the problem of transmitting, if you please, the beautiful sinusoidal currents he had obtained, and getting from them a sort of direct current. In fact, Faraday himself put on a machine like this a commutator which consisted simply of a split tube, for the purpose of reversing one wave.

As a matter of fact, the current which he got as the result of that process was by no means the equivalent of the direct current. It was a current which, to drop into the vernacular, was "steady by jerks," and was not equal to the direct current for magnetizing or for many other purposes—electrolytic, for example.

But all the previous experience had been in the direction of direct current; so the alternating current, with its very many valuable and interesting properties, was thrown away for the time being, and a good deal of ingenuity, some of it misplaced, was spent in hunting up ways for throwing away the alternating current and getting direct current from it, and it took something like 40 years before it was really well done—from 1832 to 1872 about, when Gramme and Siemens did their work in the production of direct-current dynamos.

We have in this machine then, the like of which you can see in almost any of the shops where medical coils are shown, the rudiments of the alternating dynamo, consisting simply of a pair of coils and a magnet and an arrangement to make the coils successively pass into and out of the influence of the magnets.

Of course, from a machine like this it is quite simple to pass to a form with rather more poles and with the parts rather more symmetrically developed. Our field windings would go on here forming an electro-magnet, instead of the permanent steel magnet of Faraday's experiments, and our armature coils corresponding to these would be wound on the interior revolving poles. In such a structure you would have, perhaps, one may say, according to the canons of early days, a tolerably good alternating dynamo. Of course, one can easily see that the interior of this structure might just as well be made the permanent magnet, as the exterior. In other words, we can just as well use the outside for the armature as for the field magnet,' and sometimes to-day that is done with very good results. The general effect, however, is the same. We have a magnetic structure with four poles, two north and two south, revolving with relation to armature coils, which are wound upon a contiguous iron structure. There are, to be sure, more coils, but the arrangement is essentially the same; and whether we rotate the armature or the field, whether the permanent magnet is fixed or movable from the other winding—the winding which is not on the permanent magnet—we can derive alternating currents. In a case like this it is interesting to note that we can connect the coils in which the current is produced in various ways. They can be connected in multiple just exactly as you connect batteries in multiple; or if a very high electro motive force be desired, they can be connected equally well in series, and in series most of our alternators are connected to-day, sometimes with a very great number of poles.

Some of the early alternating dynamos had about the proportions here shown, but before a great while it was found that, magnetically speaking, a machine like this is rather poor. The poles are long, the yoke is long and slim, and, altogether it would not be possible to obtain the maximum output or the maximum effective induction from any such structure. So by a short additional step we come almost to the alternator as we have it to-day. This step consists in making the magnetic structure good and arranging the armature in an effective way.

Here is a section of what would be regarded as a typical alternating dynamo, the outer portion being the field magnet, now possessed of many poles rather short and thick, instead of a few slender ones, and revolving in its interior an armature, having the rather long and ill-shaped poles modified into what are really not much more than projecting teeth. In fact, in practice, they are simply teeth cut in the iron core, taking a shape slightly different from that shown here; more generally somewhat shorter and wider than shown in this. The effect is the same as in the original old dynamo. The currents delivered are alternating, following more or less closely a sinusoidal form, and are in character precisely similar to alternating currents obtained from simpler machines.

Still another form of dynamo has been derived by suppressing the polar projections in the armature altogether, and, as you may say, cutting down the projecting poles until there are none left. In this case we have the same inwardly projecting poles. But the coils, instead of being wound about projecting teeth, are wound in spirals, and plastered, as it were, on the outside of the iron core of the armature, bent down at the ends to get out of the way, and secured by binding wires around the outside.

This is one of the comparatively modern forms of alternator. Nevertheless, in spite of the change in shape, the general result is the same, the character of the current is the same, and the only difference is the mechanical difference in the arrangement, and minor electrical differences. The two can be made nearly equivalent to each other.

Now, another and perhaps more interesting modification of the same old idea may be found. In this case we have inward projecting poles as before and the field windings upon them. But instead of the armature coils being wound on a revolving mass of metal, they are wound on the tips of the same pole pieces that carry the field coils, and the interior portion which revolves consists merely of a mass of laminated iron having projections. The result of that arrangement is, that when in the position shown, the magnetic flow produced by the field windings is at a maximum. When the interior laminated mass has turned through 45 degrees, the magnetic flow is cut down. So, you see, the same effect is produced as if the armature coil were actually taken out of effective relation with the magnetic field. The whole power of the magnet is cut off, as it were, by twisting around the interior cruciform mass of iron. When it is moved 45 degrees from its present position, we have simply a portion of a magnetic circuit which is pretty effectively broken by the gap produced by the revolution of the interior mass. The result throughout is the same; that is, the relation of the armature coil to the fixed magnet is very materially changed. The results derived from such a machine are in all practical respects similar to those derived from all the others.

Now, then, we have an idea of the way in which alternating currents are generated. The whole apparatus, whatever the modifications in form may be, consists practically of a device for continuously thrusting a coil of wire into a magnetic field and taking it out again. Faraday once made a reciprocating dynamo in which the armature coil was pushed toward and taken away from the magnet, instead of being made to get the same virtual effect by revolving. In any case, we have the reversed current waves, alike in form and following each other in regular succession.

Now, one of Faraday's most important discoveries, perhaps the most important, and the one which led more than anything else to the development of modern electricity, consisted in observing the fact that when a wire carrying a current was brought near to another wire (both being closed circuits) and the current was stopped or started suddenly, a current would momentarily flow in the wire which had no conceivable connection at first sight with the source of electricity that had been employed. Look at a curren like that. (Showing sinusoidal waves.) It is really nothing in the world but a current which is stopped and started in the opposite direction periodically. One might naturally suppose that a current stopped and started with great rapidity in this way would be able to produce very powerful effects, such as Faraday noted when he simply cut off or started a direct current, the circuit of which was in intimate relation with another and closed circuit. This fact of electro-dynamic induction lies at the bottom of our applications of alternating currents. Almost the first result of the discovery was the development of the induction coil. It was found that if you took a great many turns of wire carrying a current, and then stopped or started that current, you would obtain very powerful induced effects on circuits in the vicinity. I had hoped to be able to show a number of experiments on this topic to-night, but owing to a mistake in wiring the building, I have been unable to get current for it. The fact which Faraday discovered was, that if we had two coils of wire like these (showing), and this one is a carrying current, and they are brought into close relations with their axes in the same direction, whenever a current is stopped or started in one coil, the current starts or stops in the other coil; and this fact of induction is perhaps the most important in the whole realm of modern electricity.

It was very soon found that the action of two coils so related could be very much improved if one of them were given a core, as I am giving it one now by thrusting in a bunch of iron wire; and ere long, experiments demonstrated that if the number of convolutions in the two coils thus placed side by side and furnished with a common core were very different, some remarkable variations in the electro-motive force could be found; for example, with a battery attached to the one of these having the coarser wire, and with the current interrupted very rapidly, it might be possible to obtain from the very fine wire coil an electro-motive force high enough to give sparks of considerable length, a length enormously greater

than the mere electro-motive force of the battery could ever yield. To be sure, the amount of current diminishes just in proportion as the electro-motive force increases; in other words, the energy is substantially the same in both coils; but it was found very handy to be able to get powerful electro-motive forces in that inductive way; and before long the idea had grown into the Rhumkorff coil, which is perhaps as familiar a bit of electrical apparatus as can be found about the laboratory or work shop.

Now the Rhumkorff coil, which at first was used only for experimental, or sometimes for medical purposes, is the rudiment of our modern alternating system of distribution, just exactly as this old dynamo is the progenitor of all the modern alternating machines.

Some 30 years after the alternator had been discovered, and after its use had become a little more familiar, it was found that a current derived from it would work an induction coil of this description most beautifully, furnishing a far more powerful source of current than could ever be obtained from a battery. As a natural result of this it was put to work, and useful results were almost immediately obtained.

One of the very obvious forms of making an induction coil for such purpose is to take an iron ring (originally solid and afterwards, as the art grew, built up of iron wire), winding on one side a coil of coarse wire, to receive the alternating current, and on the other a coil of fine wire for the derived current. And in such case the electro-motive force obtained from the fine wire side device is in almost exact proportion to the relative number of turns in the two coils, the current being correspondingly in the inverse proportion. It very soon appeared that a core of this kind, particularly if solid, did not give the very best results; and the ingenuity of inventors was at once put to work to get something a little better. One of the forms obtained was this curious type—what is known as the hedgehog transformer. It is simply an induction coil where the core is of iron wire like that shown here; and in order to make the magnetic circuit more complete, to furnish a better opportunity for the magnetism to act and to bring the poles of the magnet nearer together, the wires are bent up in some such fashion as that, the coils either being placed as I have them here or as shown in Fig. 7, where a coarse wire coil carrying the current from the dynamo is wound immediately about the core, and the fine wire coil for the derived current carried outside. Such an apparatus is nothing but a modification of the old Rhumkorff coil with which we have all been tolerably familiar.

It really is remarkable, considering the simplicity of the apparatus, that the induction coil was not put to effective commercial use long before it was. But it was many years after the Rhumkorff coil appeared before it occurred to anybody to revert to the old type of dynamo and work it in connection with an induction coil, giving, as it does, the enormously valuable property of being able to shift at will the magnitude of the electro motive force; to start with 10 volts and rise, if you like, to 10,000, and then go back again, by going to another similar bit of apparatus and putting the 10,000 volts into the fine coil and taking anything you please out of a properly wound coarse coil on the same core.

More than 60 years ago it was that the alternating dynamo was invented, and it was only about 15 years ago that it first occurred to anybody to put the inductive powers of the alternating current—which are simply due to the fact that it stops and starts, so to speak, with great rapidity, perhaps 100 times a second—to any great commercial use.

The form of the commercial transformer, as it is now found, is very widely modified from the simple induction coil as I have shown it here.

In a general way the transformer, as we have it to-day, consists of a great pile of laminated iron plates, in form something like what I have shown here, with the exception that the interior piece here shown by dotted lines is not put in when the plates are assembled, but is left to be put in afterwards. This mass of square pieces of iron is built up and clamped together. The coils are then wound, in rather flat shape, and they are slipped over a pile of little iron plates. These coils and plates together are forced down into the interior of the hollow box of iron laminæ, forming the outside of the transformer. The magnetic circuit in such a case is round in that fashion (showing), he whole mass of coils being, however, surrounded by iron. That is the up-shot of the induction coil, and it is in that form that the induction coil is put to practical use. It is perfectly possible to go up to any voltage in a ratio of 40 or 50 or 100 to 1, obtaining, if you like, 10,000 volts from 100; to transmit a current proportionately small at that high voltage, anywhere you please, and then to get down again to your working potential of 100 volts at the other end of the line. It was such a current of 100 volts that I had hoped to have in here to-night, derived from a transformer very much after that style, and receiving current from a rather high voltage dynamo in the down-town central station.

The transformer, then, is nothing more nor less than our old friend the Rhumkorff coil put into practical commercial shape.

The alternating central station to-day consists of a dynamo in one of the later forms which I described, with lines ranging out from it spider-web like, all over the region that is to be supplied, and at relatively high voltage, generally 1,000 or 2,000 volts, and then, at the end of the line, or wherever it is desired to obtain lights, an induction coil wound with such a ratio of the number of windings in the two coils as to reduce the voltage from, say, 1,000 to 100 or to 50. Thus, we can start with an alternating dynamo and obtain lights very beautifully and easily from it; can transmit the energy

Mr. Wm. S. Hine, President Wallace Electric Company, Chicago.

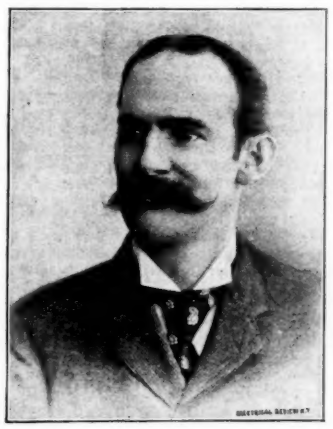
at any voltage we please, and pass to any other voltage by means of an alternating transformer. It gives us, you see, a power over the voltage which we want to use for various purposes that is almost unlimited; a power far greater than we could ever have with the direct current even at its best, because the efficiency of transformation in the alternating transformer is very high; it may be 95, 96 or 97 per cent., the losses being exceedingly minute, in large transformers particularly.

(To be concluded.)

Electrical Signaling by the Telephotos.

There was exhibited at the Royal United Service Institution recently an invention by Mr. C. V. Boughton, which he has called the telephotos. It is designed for signaling by night or day, at sea or during military tactics on land. At the same time a paper was read on the subject by Col. G. E. Gouraud, late of the United States Army. The object aimed at is to signal by the Morse alphabet, displaying simultaneously all the symbols which go to make up a letter or signal, instead of flashing them from the masthead in succession, as in the present system of Admiral Colomb. This latter system has been found to work well, but, as Lord George Hamilton, who presided, remarked, all present tendencies are toward concentration, and the mobility of a fleet depends in large measure on the success with which means can be adopted for facilitating co-operation and combination. An essential feature, therefore, is rapidity of signaling, and it seems possible to attain higher speed in showing all the symbols simultaneously than in flashing them in succession. It is claimed that 100 letters were sent per minute by the telephotos. The theory of the telephotos is the production of the symbols by electric light in lamps mounted on a long shaft, 10 lighted lamps in a line of five feet in length representing a dash, and one light a dot. There is an unlighted interval between each dot or dash of at least five feet in length. The number of lamps required is 53, and these are mounted on a shaft 27 feet long. The switch board is only 11 inches by 14 inches, and may control lamps for two shafts. It is fitted in a case mounted on a pedestal. At one end of the pedestal is fitted a keyboard corresponding to that on a typewriting machine, and the keys have raised on their under sides the Morse characters for the respective letters, in brass with platinum points. The cross-bars, 106 in number, are flexible and imbedded in hard rubber. The pressing down of the key makes contact with such cross-bars as are immediately opposite to the platinum-pointed brass projections on the key corresponding to the Morse symbols which represent the particular letter. Wires are led from each cross-bar to a lamp on the shaft, and thus the signal corresponds with the symbols. A groove under the keys contains a number of fine steel balls similar to those used in the bearings of cycles, with $\frac{1}{16}$ inch of lost motion—the thickness of the key. The pressing down of the key causes these balls to lock all the other keys. The lamp is of special construction. It is flatter in the face than the usual incandescent globe, resembling an ordinary door knob, and the filament of 10 coils is placed crosswise in order to secure the greatest light surface. Each lamp is fitted into a special bell mouthed casing with a parabolic metal reflector, and in front there is a lens screwed on. This latter, it is said, has the effect of screening the expiring incandescence of the filament of the lamp. Of course it will be understood that the lamps may be used for any or all successive letters, for the lamps used are determined by the spacing necessary for the symbols in the letter, and here it may be stated that where practicable the symbols are as far divided as possible. Thus "m," equal to two dashes, would require 10 lights at either end of the 27 foot shaft to be lighted; while "i," equal to two dots, would require the extreme end lights on the shaft to be illumined.

An important consideration is that by auxiliary mechanism a permanent record in writing of the signal given is kept. Above the keys for making the electrical contact with the cross-bars is a cylinder with an adaptation of the ordinary typewriting machine, and 36 double magnets for throwing the Roman type of the symbol displayed on to a paper ribbon. This recording apparatus may be kept under seal. There are a great variety of means of applying the invention. Several navy officers,



Mr. J. B. Wallace, General Manager Wallace Electric Company, Chicago.

while recognizing the ingenuity displayed, seemed inclined to regard it as much too intricate, and therefore liable to get out of gear. Admiral Colomb, who is a great authority on the subject, expressed a desire for a more intimate acquaintance with the mechanism, which he seemed to regard as unique in conception. Indeed, he urged the necessity of a practical trial, and indicated a belief that modifications might be made. The direction of these modifications he did not indicate; but satisfaction was expressed at the probability of the working of the telephotos being demonstrated from one of the buildings on the London Embankment. At present it is in use at Rio de Janeiro, on an elevated part of the city—La Gloria—overlooking the bay. But clearly the best method of testing its efficiency would be to fit it into some of the vessels of the fleet now in commission.

As to its application in the field, a light horse wagon has been designed for military use, the shaft being easily erected and worked on a swivelling joint, while the electric power is provided by an oil engine and dynamo, the weight of the whole apparatus when complete being only 1,000 pounds; but this, as one of the chief signaling officers in the army pointed out, is a great increase to the impediments of a force in open country.

As to the penetrating power of the lights, Mr. Boughton, the inventor, states that at two and a half miles, in bright sunshine and clear sky, the signal has been read with the aid of an ordinary glass, while at night the distance is 10 miles.—*London Engineering.*

The Wallace Electric Company, Chicago.

The latest newcomer in the electrical field is the Wallace Electric Company, 104 Michigan avenue, Chicago, which has been organized to conduct a business in electrical goods as manufacturers and manufacturers' agents. The company is not an electrical supply house, but is in a position to sell directly to large consumers and the trade at manufacturers' prices and without an intervening profit.

The company's line will include alternating current generators, motors, meters and transformers; wires and cables for all electrical purposes; incandescent and arc lamps; measuring and indicating instruments; switches and a full assortment of electric railway supplies and appliances, as well as a few carefully selected specialties.

The officers of the company are gentlemen of extended experience and wide acquaintance in the electrical fraternity. The president, Mr. William S. Hine, is especially well known in the East. He will be remembered as one of the best *raconteurs* of the New York Electric Club, and also as possessing a very fine and well trained voice which was always at the disposal of the club's entertainment committee. Mr. Hine was born at Bridgeport, Conn., March 7, 1853, and graduated from Yale in the class of '77 with the degree of Ph. B. He has had a large experience in the electrical field through his connections with the United States Electric Lighting Company and the Westinghouse Electric and Manufacturing Company, as general district agent. Mr. Hine has latterly been the general sales manager for the J. T. Case Engine Company, of New Britain, Conn., whose service he left to join the force of the Wallace Electric Company.

Mr. J. B. Wallace, the general manager of the company, is a member of the famous Connecticut family of that name, and has been actively identified with electrical industries from the earliest days of electric lighting in this country. Mr. Wallace spent several years as an employé in his father's wire mills, and is to-day one of the most expert wire drawers in the United States. Much to his disappointment he was prevented by ill health from attending Yale University. He went through every branch of wire making, and assisted Mr. William Wallace in some of his early work in electric lighting. Mr. Wallace conceived and organized the electrical supply department of Wallace & Sons, at Ansonia, Conn., which later became well known as the Electrical Supply Company, of Chicago, and finally the Ansonia Electric Company. Mr. Wallace brings to the new company bearing his name a wealth of practical experience which cannot prove otherwise than of the greatest value.

Mr. Max A. Berg, the secretary of the Wallace Electric Company, will be remembered as the former manager of the street railway department of the Ansonia Electric Company, of Chicago.

Mr. M. M. Wood, the electrical engineer of the Wallace Electric Company's street railway department, is rapidly achieving fame as the inventor of numerous special devices which are becoming standards for street railway construction.

The company has in press catalogues, price lists and other printed matter which will be mailed on application. The Wallace Electric Company is already thoroughly equipped to promptly and satisfactorily handle orders.

In the Ohio Senate, on January 22, Mr. Gear introduced a bill limiting the rental of telephones. It classifies the cities of the State in three grades: Class 1 being those cities having a population of 100,000 or more; Class 2 from 50,000 to 100,000, and Class 3 comprising cities of less than 50,000 population. In Class 1 rental shall not exceed $3 a month for private lines or $2 a month for each telephone on one line where there are two or more on one line. Class 2, the charges are limited to $2.50 and $2 a month, and in cities of Class 3 the charges shall be not more than $1.50 and $1 per month.

The Practicability of Electric Conduit Railways.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, DECEMBER 20, 1893, BY ALBERT STETSON.

(*Concluded from page 51.*)

Mr. Stetson: As to the number of switches that there must be per mile with the system built as it is, I admit that that is the real fact; it will take about 1,000 switches to the mile. But whether there are 1,000 or 10,000 switches to the mile, it all depends on the construction of the device you have, as to whether you are likely to have a break-down. If I had the new box here I could show you a device in which the working parts are reduced to about one-third of what they are in this box. The blow is reduced to next to nothing. There is nothing but a flat spring and a flat brush. If you have got to have a device, I claim that you would hardly be able to get it simpler than two parts. As to the blow struck, I was talking with an electrician connected with one of the big companies, and he said: "It has been tried and you will find it won't work." I found nothing of the sort. In the first place there is not such a blow as you would get in striking with a hammer. That stroke is sharp. This is simply a pushing aside.

Mr. Hewitt: Don't you retain in your new box the spring device on which that plug operates?

Mr. Stetson: No, we do not retain that. That is not good.

Mr. Hewitt: You make that solid then.

Mr. Stetson: Yes. As you work with things like this, you proceed rather from the complex to the simple than from the simple to the complex. You must be able to go backward or forward. If the arm were rigid and you were going in one direction and wanted to come back, you would either tear the spindle off or damage your shoe. So we made the arm yielding. That old box had three parts. The objections that you brought up were good ones. I will bring up some more. The principal objection to this old box is the expense. This box would cost $1.50; the new box will not cost $1. In the old box there were five surfaces that were planed on a planing machine. That costs money and takes time. It would seem, after you had planed it and used oil paper, as though you might get a joint that would hold paraffine oil. But we couldn't do it. You do not want any joints. The new box is one solid piece of iron. I admit that there are working parts in the box that we have, but we have reduced them to two, one being a long brush and the other a good stiff flat spring.

I will state, in reference to the Love conduit system, that I was not able to get reliable information in reference thereto. The information I wanted I could not get. I did talk with some good men, and was guided a great deal by their opinion of the Love conduit in what I said about it. I would state about Chicago that I estimated the length as well as I could from Crosby and Bell's book. The road was not running when I was there. You must know that Bentley and Knight had a number of patents, and means of protecting their wires as the Love system has.

Mr. Joseph Sachs: Mr. Chairman, in reference to the mud test, when the shoe was entirely submerged, I fully agree with Mr. Hewitt in saying that that only showed the resistance of that type of mud. Mr. Stetson has stated, I believe, in his paper that the trouble with the bare continuous wire conduit system has been that the mud would get down through the slot and settle on the wires and cause leakage. There is nothing at all to hinder the mud from collecting on the shoe, while it is in contact with the switch boxes, causing leakage between the two sides thereof, particularly when the brush passes through a section of conduit that is entirely submerged, as in the test.

Mr. Stetson has also forgotten a type of system with which I had a little experience. I had occasion to construct a short line of this system, also, at Coney Island. It is a system which has contact surfaces, either on the surface of the road or in a conduit, but the mechanism for controlling these sections, or plates, or contact wires, is entirely out of the road bed, and put in such position that it can readily be gotten at, repaired, changed, or tested, at any time. As Mr. Hewitt has said, any mechanism placed in the road bed is always apt to become disarranged and there is always a question whether anything of the kind would prove a practical success. Numerous small electrical devices located in a conduit or underground are apt to give a great deal of trouble. In my mind, a system which would operate as well, and perhaps even better, would be one in which contact sections or contact points are placed along a conduit, and these contacts actuated one after another from some source exterior to the road bed, or so located to be accessible.

Mr. Stetson seems to place particular stress on the failure of magnetic cut-outs to work satisfactorily, but I will assure Mr. Stetson that I devised a form of magnetic cut-outs which were used on this particular road that I have in mind which worked very well. It was not a question of the failure of magnetic cut-outs, but was a question of the type of track construction that was used. We used iron plates, about 6x9 inches, placed in the center of the track upon wooden planks, not painted or treated at all, but just rough wooden planks, and these were in the form of a square, closed trough, with the plates on top. This conduit was about 4x4 and contained the wires which were connected with different heads or contact plates. The contact heads were placed 10 feet apart, and at every 240 feet was a distributing box located on a post adjacent to the track. A wire from the different plates ran to the distributing box, and within this box magnetic cut-outs were located. A tap from the main feeder in the conduit was also brought to the distributing box, and this wire was at various times thrown into connection with the different heads as the car proceeded by the magnetic cut-outs. The current was taken from the plates by a brush underneath the car which was long enough to touch two plates. The rails were used as a return. We had what was called a surface contact system. The construction was the very crudest, but the installation showed that the placing of the contact controlling mechanism out of the road bed was entirely feasible. From experiments I made at that time I do not believe that a surface contact system, that is, where the contacts feeding the current to the car are located on the surface of the street, is adapted to our large cities. But if these contacts were put into a conduit and proper drainage used, and the conduit made of the same size as Mr. Stetson proposes, or the same size as the Love conduit, I do not believe there can be any question as to the operation of such a system, and such a system would undoubtedly operate in perhaps as efficient a manner, and perhaps a better manner, than any system in which the contact device and mechanism was located in the duct.

There is another point about Mr. Stetson's system which I would like to know, and that is this: What provision is there made for preventing the arms from sticking, and what provision is there also made for getting at the boxes to repair and renew them or refill them with oil if the oil should leak out.

Mr. Stetson: That has all been worked out in the new device. In the new system the switch device is not in the conduit. It is in the road bed right where it ought to be. All that is necessary in the new system is simply to lift up a square iron plate, take out the whole inside mechanism and put it back. I know the system that you speak of. I examined it very carefully and made a report on it.

Mr. Sachs: I believe there was a method devised and tried some time ago by Messrs. McElroy and Nicholson. This system contemplated putting in the road bed a number of boxes, similar to the contact heads which I had reference to. In these contact heads were located electro magnets, and instead of the contact heads or arms, as they would be called in Mr. Stetson's system, being actuated mechanically, they would be thrown in connection with the feeder from the dynamo by the magnetic cut outs located therein. It was found in a short time, from the sparking and the moisture, that the mechanism became entirely disarranged.

Mr. Hewitt's remark about the number of devices used I think is a very correct one. No matter how simply the devices are made they certainly do get a great deal of wear and tear. The action of this shoe upon the arm does certainly amount to something, even though it is only a push, and I should think that the noise, on a system like the Broadway road, where, as Mr. Hewitt says, there is about a car a minute, would be quite noticeable and objectionable.

Mr. Stetson: Why didn't you come down and see it during the Summer? You would have found an entire absence of anything of the sort. There is no noise from those rappings at all.

Mr. Sachs: There is another reason perhaps for no noise being made. I merely studied the system from various articles that have appeared in the journals and know from my previous experience, having studied that peculiar class of electric railroads to some extent, just what the requirements and conditions are. As I understand the system down at Coney Island, the conduit you have is not a conduit but an open trough and is not enclosed at all. As I understand it, your contact boxes are located upon the same level with your tracks. Actually you have not got a conduit system there but a surface contact system. No such system with such contact boxes could be used on Broadway.

Mr. Stetson: I do not think we ought to go quite so wide from the subject as that. That was simply a matter of avoiding splitting the cross ties of the track. We preferred to have it on top as a means of avoiding expense.

Mr. Sachs: I made that same test myself with the system we had at Coney Island. Our plates were located right on the surface, and I took this same Coney Island mud and I tried to make the same test. I got some peculiar results. I got about one-half an ampere or so on each head when the mud was right up flush with the rail on about 400 volts pressure. Upon thinking the matter over and examining the mud I found I was wrong and that this mud was rather different from ordinary city mud and there was not very much path for the current to go through wet sand. The water we used was fresh water, as I supposed yours was. I suppose the effect you got was very much like the effect I got. As regards putting the heads on the surface and getting the poorest condition you can get, I do not agree with you, as I believe a submerged conduit is much worse than a surface contact system under ordinary conditions. I do not want to say that the system is not operative, because I believe it is. I think the system will work. But I am merely giving my experience and views in the matter, and I think when you put these boxes in the conduit with the rattling all along it, you will find there is quite a good deal of noise, and will find other difficulties not met with in your experimental installation.

Mr. Stetson: They are not in the conduit.

Mr. Sachs: The arms are in the conduit; that is where the noise comes from—not from the box. There is another point: when you get your arms in the conduit how about the mud collecting on your box and contact arms? I believe that a practical conduit system can be operated, something of the class that Wheless or Hunter and several others have proposed, viz., a conduit not very large, with sections therein, or contact plates therein, and each contact plate being put into action one after the other by a series of magnetic cut outs. Now the preferable form would certainly be to locate these cut-outs exterior to the road bed, and by so locating them, all the dangers that Mr. Stetson has talked about would be eliminated. Such would certainly be an efficient system if properly installed, and the leakage would be brought down to the minimum.

Mr. Stetson: In reference to that, I prefer a mechanical action to any electro magnetic action.

Mr. F. A. Scheffler: The author has made such rabid statements in reference to the use of closed conduits that I feel disposed to offer some suggestions to contradict such inferences as he makes. I believe firmly that the future will show that a successful closed conduit can be maintained, which can be manufactured and constructed for much less money in first cost per mile than any system heretofore offered for open conduits.

A closed conduit will also have many more advantages, especially those of operating expenses, than an open conduit. If a conduit filled with water can show such elegant results as to leakage measurements as are set forth in the test of Mr. Stetson's system, it seems to me that a closed conduit which cannot be filled with water even to make a test for leakage would be far superior for actual operation to the open conduit. The results of Mr. Stetson's tests are remarkable, and while I do not question their accuracy (although it is somewhat out of the general rule to correct matters which have been stated and an affidavit attached certifying to their correctness), it seems almost impossible to believe that it would take 4,484 boxes entirely submerged to give a loss of 2,113 amperes, or through a distance of over five miles.

If you can secure such results with a conduit full of water and five miles long, why not throw away the conduit and use the surface where such an accumulation of water is impossible, as to quantity? A surface accumulation would be of higher resistance than a body of water six or seven inches in diameter, hence the leakage would be much less on a closed conduit. Mr. Stetson proves by his test that his theory of extreme leakage in enclosed conduit can be overcome, for if it can be done underground in an open system why should it be not easier accomplished by a closed system—when one learns how to do it?

The Metropolitan Traction Company has offered $50,000 as a prize for the best system which shall do away with the "deadly" trolley. I am very anxious to own that prize and would feel pretty sure of getting it were it not for the fact that I may only take the chances with a thousand others. I venture to make the broad statement that the prize will be given—if it is for an electrical system—for a closed conduit system which shall operate in the same every-day stay-with-you manner that Mr. Stetson has so intelligently outlined.

Mr. Stetson: I want to ask the gentleman if he thought about this question of closed conduits. I have given quite a little thought to them.

Mr. Scheffler: I have looked at it, sir.

Mr. Sachs: Pardon me for taking up so much of your time, but permit me to say another word in reference to closed conduits. I tried to do a little in that direction, and I think that Mr. Scheffler is quite correct in his assertions that the leakage in a surface contact system would certainly be less than that in a conduit system which was entirely submerged, that is, one in which the contact devices were entirely submerged. In a surface contact system it is usual to put the contacts in the center of the track at the highest point. Now being brought to that highest point between the rails, the moisture, or mud, or dirt, has a tendency to settle down on the rails, and the quantity of dirt and moisture that would get between your rails, which would perhaps form your return conductor, the plate or contact would be of much higher resistance than that collected in the submerged conduit, as Mr. Stetson puts it. I think that, taking the submerged conduit on the one hand and a surface contact system properly constructed and in a similar location on the other, the advantage would be with the latter in reference to a minimum leakage.

Mr. W. T. M. Mottram: There is one point that has not been shown up very fully here, and that is this: Wherever the car is in service the current is exposed, is it not? Now if the contact strip is standing in water, it is bringing the current right into the water. Now it is quite conceivable to me that there would be a piece of track on some ordinary line, of a thousand feet in length, in which the conduit would be full of water. It is also conceivable that there might be 20 live cars standing on that piece of track. If you turn 500 volts lose at 20 different points with metallic strips, each about nine feet long, your short-circuit will simply close you down.

ELECTRIC LIGHT FLASHES.

Yorkville, Pa., wants electric lights.

At a meeting of the directors of the Edison Electric Illuminating Company, of Boston, a quarterly dividend of 1½ per cent. was declared payable February 1, 1894, to stockholders of record at close of business, January 22.

The annual meeting of the stockholders of the National Carbon Company was held last week at the company's office in West Cleveland, Ohio. It was decided to open several departments of the new works within the next two weeks, which will give employment to more than 200 men.

Depositions are being taken before United States Commissioner Hinsdale in the case of the Denver Consolidated Electric Light Company *vs.* the Standard Underground Cable Company, of Pittsburgh, Pa., for damages in the sum of $50,000. The Denver people charge a breach of warranty on a defective cable they bought, back in 1887, and want to be indemnified.

The rise of 19 feet in the Williamette River has so lessened the fall of water at Oregon City, Ore., that the Portland General Electric Company's station at that point is developing only a fraction of the power necessary to light the streets of Portland. In consequence the company has had to call into service the old steam plant on the east side, and for the second time this Winter suspend work on its new power house at Oregon City.

Mr. E. P. Roberts, of Cleveland, Ohio, was recently in Detroit, to attend the opening of the bids for the electric light plant for the Home Savings Bank Company, the specifications for which he prepared. The two engines will be the "Ideal;" the dynamos, switch board and wiring will be furnished by the Detroit Motor Company, and the wiring will be done with okonite and interior conduit. The specifications were very complete, giving feet of wire on each floor and total of each size, etc. There will be over two miles of No. 14 wire, with less quantities of larger sizes.

Electric Lighting of Paris.

Estimates have recently been prepared as to the cost of lighting Paris during 1894. The total amount is $1,580,000, of which $101,490 is to be devoted to the electric lighting of the public streets; $117,400 to the electric lighting of the markets, abattoirs and various municipal buildings; and $91,280 for the maintenance of the municipal central electric lighting station at Les Halles Centrales.

TELEPHONE NEWS AND COMMENT.

The Interesting Events of the Last Week in This Field—American Bell to Increase its Capital to Fifty Million—Sell Receivers at $1.75—New Companies Organized to Install Exchanges and Sell Instruments.

Many features of interest in telephone circles showed up during the past week and there are many more to follow. The expiration of one patent of Alexander Graham Bell has stirred up the liveliest kind of competition, and capital is being attracted to the new companies in a way that must bring joy to the hearts of the promoters, and surprise to the officials of the one-time monopoly, that is now selling telephone receivers at $1.75 each, reduced to that figure from $2.50, the price first announced.

The controlling item of business in the telephone world this week was the application of the American Bell Telephone Company to increase its capital stock from $20,000,000 to $50,000,000. President Hudson of the company declined to make any statement as to the use to which the proposed new capital will be put. It was learned that there are three objects under consideration. The first is reference to the long distance lines now owned by a separate company, the American Telephone and Telegraph Company, the stock of which is largely held by the Bell company. The second is said to be the absorption of some subordinate companies now paying royalties, but which the Bell Company wishes to rearrange on another basis. The third is perhaps the most important, and is to make preparation for the competition expected to follow the expiration of the telephone patents. It is reported from Boston that royalties will be reduced; may be reduced $3 or $2, which would have the effect of cutting down dividends. The stock was quite active on the Boston Exchange, advancing on the news of the increase in capital from 170½ to 176. This was on the idea that stockholders will have rights to subscribe to the new stock.

Ex Governor Long, the Boston counsel of the company, says:

"There is nothing upon which to base the story that the company desires the extra capital to protect itself against other patents, or for the absorption of other companies.

"The Bell Telephone Company has been interested in a large number of other companies all over the country in which it holds shares of stock. It has grown so that it has interests in, I think, every State in the Union, and they center right here in Boston.

"It is simply a case of the head getting too large for the hat it wears and the necessity of increasing the size. It is of great interest to Massachusetts also, and should be a source of gratification and of pride to the citizens of the commonwealth, that the company which has its center here has achieved such success.

"No, the only thing for which the Bell company asks this increase of capital is to enable it to meet the growth and development of its business. Its purpose is simply to ask for such increase of the capital stock as will enable it to carry on its enlarged business."

The Viaduct Company, Baltimore, with the genial Mr. A. G. Davis at the head, will supply you with telephones.

The Laclede Carbon and Electric Company, P. C. Burns, manager, is in the telephone business at Kokomo, Ind.

There are going to be a number of surprises in telephone circles real soon. Some of them may disturb the equilibrium of the American Bell.

The name of C. N. Fay, formerly of the Chicago Telephone Company, would be a strong one on the board of managers of any new telephone company.

Mr. H. H. Eldred, one time an active telephone man, has again entered the field and is connected with the Strowger licensees at 35 Wall street, New York.

Mr. Chas. Selden, general superintendent of telegraph for the Baltimore and Ohio Railroad, is one of the technical telephone men whose inventive record is first-class.

There are a great many able ex-telephone men lying around loose these days. If we were going into the telephone business the most practical ones would not be loose long.

Augusta, Ga., is happy over the prospect of telephone service at $20.00 per year. Canvas back duck and burgundy at the price of frankfurters and beer is just the thing to please all of us.

No, "Anxious Inquirer," the patent on the automatic gravity switch—the Roosevelt patent—has not expired. "How to get around it?" Consult an electrician; consult an able electrician.

The Lowth stethophone—he throat telephone—is to be introduced in Providence. The promoter tells a reporter that the differences between this system and the vibrating diaphragm are "several." He is dead right.

J. H. Bunnell & Co., one of the reliable electrical houses of this city, announce their readiness to deliver telephone supplies. The goods from this house come from the hands of experienced men who know what is needed.

Elias Groff, of Krick's Mill, Pennsylvania, is to patent a telephone "based upon an entirely new principle in acoustics." We wish Elias well, but fear his name or the name of his mill will hoodoo that new principle.

The Metropolitan Telephone and Telegraph Company have facilities for manufacturing 1,000 telephone receivers a day. This company supplies the New York and New Jersey Company, which has also arranged to sell.

The Clamond patents, which are reported sold to a Philadelphia syndicate for a quarter of a million, were fully described in the issues of the ELECTRICAL REVIEW for February 4 and March 4, 1893: price, 25 cents per copy.

George H. Stitch, of Chicago, representing the Illinois company, which controls the Strowger Automatic Telephone Exchange, is negotiating with local capitalists, at Eau Claire, Wis., to form a stock company with $50,000 capital to put in an exchange.

The Drawbaugh people are lifting their heads in Pennsylvania. Daniel Drawbaugh had numerous influential backers once; if they are still inclined that way they have had experience enough in the past to make them formidable opponents in the future.

The Erie Telegraph and Telephone Company has declared a quarterly dividend of one per cent. which will be paid by check mailed to stockholders February 19, 1894, that are of record at noon, Saturday, February 10. The stock books will be closed at noon, February 10, and opened Monday, February 19, 1894.

The *Times*, of McKeesport, Pa., claims that the Shaver Company's switchboard in that city, which is to be put in use at once, was examined by Mr. Adee, of the Bell company, who stated that this was the "only switchboard he had come across that did not infringe." There may be some others now, Mr. Adee; in fact, several others.

At 12.30 o'clock A. M., on January 21, the terminal and operating rooms of the Ohio Valley Telephone Company, at Louisville, Ky., were gutted by fire and every telephone in the city was rendered useless. It will be three months, so Manager Gifford says, before the service can be completely restored. It is estimated that the loss, including rentals, will reach $80,000 or $100,000. There is $25,000 insurance on the fixtures.

Texas, considered by the addition table applied to letters of inquiry sent to this office, takes more interest in the telephone question than any other State in the Union. A writer—a new subscriber to the REVIEW—says: "Perhaps you do not know or realize, but it is a fact, that thousands of cities, towns and villages are eagerly watching for telephone news in the South. The monopoly has heretofore barred them out and now they are eager for a fight. Don't neglect the telephone." We won't—we never have.

The ELECTRICAL REVIEW has called down on its unshorn and good-natured head the anathemas of a zealous friend of the Harrison International Telephone Company, of Chicago, because, forsooth, we glanced a little askance at their 80 millions of capital. Don't bother. Just raise that 80 millions, take 50 millions of it and buy the American Bell out, which is a little more than its market price to-day, and use the other 30 millions in developing and improving the service and reducing the rates, and you and everybody else will rejoice and be glad, and all competition will disappear.

The sole licensee of the Strowger automatic switch for New York is the Automatic Telephone and Electric Company, of 35 Wall street, New York; J. Wesley Allison, president, and J. R. MacArthur, secretary. Among the stockholders are announced the names of Hon. Smith M. Weed, Hon. W. L. Trenholm, Gen. Steward L. Woodford and J. H. Flagler. These are good men. Gen. Woodford and ex Congressman Wallace are the attorneys of the company, which announces its intention of entering the telephone field in New York and Brooklyn at the rate, without tolls, of $120 per telephone exchange set per annum.

N. I. R. Wire Tests.

The Metropolitan Electric Company, general western agents for the N. I. R. wire and cables, have just recently had some very satisfactory tests from two of the largest buildings in Chicago, in which their wire is used.

The N. I. R factory have enlarged their line of products, and are now making electrolier wire, lamp cord, rubber and friction tape; all in harmony with their regular wires and cables, which have so generally been regarded by the trade as first-class in every respect. A full stock of these goods will hereafter be carried by the Metropolitan Electric Company, at prices to suit the times.

Business Troubles.

ELKHART, IND.—D. Baugher has been appointed receiver of the Adams Electric Company, manufacturers of electrical apparatus. The company has assigned its book accounts to Pope & Jones.

RICHMOND, IND.—Union Trust Company, of St. Louis, on January 20, filed suit against the Richmond Electric Street Railway on bonds for $212,000. A. D. Titsworth was appointed receiver with a bond of $50,000. Col. John F. Miller, superintendent of the Pennsylvania lines west of Pittsburgh, and Russell Harrison, are the chief owners.

NEW YORK CITY.—Judgment for $19,732 was entered on Jan. 31 against the American Universal Electric Company, of Washington and Cedar streets, in favor of Andrew P. Morrison, for money advanced between Jan. 1, 1891, and Nov. 15, 1893. The company was formerly known as the Wright Universal Electric Company, which was incorporated under West Virginia laws in March, 1892, with a capital stock of $5,000,000.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Manufacturing Companies.

CANISTOTO, N. Y.—The New York State Electric Company, incorporated; capital, $25,000. Clair House.

NEW YORK, N. Y.—Non-Electric Fibre Company, incorporated; capital, $250,000. Mark L. Deering.

KANSAS CITY, MO.—The Electric Cash Carrier and Change Maker Company, incorporated; capital, $100,000. George P. Gross.

CHICAGO.—The Chicago Accumulator Company, incorporated; capital, $30,000. F. W. Moore.

EAST ST. LOUIS.—The Mark Railway Equipment Company, incorporated; capital, $10,000. F. S. Taggert.

SAN FRANCISCO.—The Providence Electrical Supplies Company, San Francisco, capital, $100,000 has been incorporated.

NEW YORK CITY.—Acme Belting Company, of New York, to manufacture and sell leather and rubber belting, etc.; capital, $30,000. Directors, George A. Pierce, George T. Moore, of New York, George F. Page, of Concord, N. H., and others.

CHICAGO, ILL.—The Chicago (Ill) Electric Storage and Equipment Company has been incorporated with a capital stock of $250,000. The incorporators, R. W. Applegate, Oliver R. Stratton and H. Bartlet Lindley. The company propose to manufacture electric storage batteries under the Fenton and Elliot patents, which have been purchased from the original holders.

CHICAGO, ILL.—Chicago Electric Company; capital, $1,000,000. Incorporators, W. M. Lenhart, J. W. Alderman and E. S. Norton.

DETROIT, MICH.—The Jennings Cellulose Secondary Battery Company; capital, $15,000.

BALTIMORE, MD.—The American Signal Company; capital, $5,000.

NEW YORK CITY.—The Metropolitan Electric Equipment Company, of New York city; capital, $20,000. Directors, Maurice T. Ward and Darius Colomboni, New York city, and James F. Hughes, Brooklyn.

CLINTON, ME.—The Bradford Self-Closing Telegraph Key Company has been organized.

MILWAUKEE, WIS.—Central Service Electric Company, to deal in heat regulating apparatus and electrical and pneumatic appliances; capital, $100,000. Incorporators, Francis Hinton, William F. Howell and William D. Van Dyke.

New Electric Railways.

PORTLAND, ORE.—The Point Defiance and Edison Railway Company has issued to the Northwest General Electric Company a mortgage to secure an indebtedness of $96,000.

LA SALLE—The Inter-Urban Electric Railway Company, incorporated, $250,000; C. M. Palmer.

Electric Light and Power.

SAN FRANCISCO.—The Harbor Light and Power Company, incorporated, $100,000; A. Devoto.

KINDRED INTERESTS

The Grosvenor-Dale Company, at Grosvenor-Dale, Conn., are building their new coal sheds of iron. The construction is designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and is so arranged that the coal can be unloaded direct from the cars into the pockets without handling. The Grosvenor-Dale Company expect to save a large amount of money each year by saving the expense of handling their coal the second time.

About a Year Ago the Joseph Dixon Crucible Company, of Jersey City, issued a pamphlet on lubricating graphite. It embodied an elaborate scientific opinion by Prof. R. H. Thurston on the value of graphite as a lubricant, and much interesting information on the subject from practical men. The pamphlet has had a large circulation, and the company has been enabled to obtain from well-known men a vast amount of additional knowledge on the uses of graphite. Another pamphlet, twice the size of the former, will be issued early in February, and a copy will be sent free of charge to all interested in the subject of friction and lubrication.

Queen & Company, incorporated, Philadelphia, are about to bring out a line of standard voltmeters on the "hot-wire" plan made under the fundamental Cardew and other more recent patents. These instruments prove extremely accurate for both direct and alternating circuits, which is confirmed by an award received at the World's Fair for "Success attained in overcoming the defects of the ordinary hot-wire instrument, viz: Lack of great range through which the instrument is sensitive, great correction due to change of temperature and inconstancy of zero point, and also for its compactness, portability and excellence of mechanical construction." Exhaustive experimental work conducted in the Queen laboratory for more than a year past, enables the makers to feel great confidence in the efficiency of the "Acme" standard voltmeters, the portable type of which will be ready for sale in a few weeks. A price list and full particulars will be issued shortly.

THE CITY OF DALLAS.

EXECUTIVE DEPARTMENT,
W. C. CONNOR, Mayor.

Dallas, Texas, January 19, 1894.

Notice to Electric Light Builders.

The City of Dallas, Texas, will receive sealed proposals for the building of an Electric Light plant for the public lighting of the City.

The approximate wants of the City will be as follows:

Arc Lights (double), 2,000 Candle-power, 300.

Incandescent Lights, 30 Candle-power, 1,000, and 80 miles of wire in four circuits, necessary boiler and engine power, poles, etc. Buildings to be furnished by the City.

Bids will also be received to light the City, furnishing 300 Arc and 1,000 Incandescent Lights for a five year contract, to take effect Oct. 1, 1894.

All bids to be received by March 1, 1894.

Address,

GEO. W. CRUTCHER,
City Secretary.

Good Telephone Books.

"PRACTICAL INFORMATION FOR TELEPHONISTS,"

BY THOMAS D. LOCKWOOD.
The Telephone Man's Text Book.
192 Pages. Price, $1.00.

"TELEPHONES, THEIR CONSTRUCTION AND FITTING,"

BY F. C. ALLSOP.
Description of Receivers, Transmitters, Switch Boards, Complete Instrument Switches and Switch Boards, Erecting Telephone Lines, Overhead Wires, Instruments, Connecting, Testing for and removing faults.
256 Pages. Illustrated. Price, $2.00.

"TELEPHONE LINES AND THEIR PROPERTIES,"

BY W. J. HOPKINS.
Contents: Design and Construction of City Lines.
Underground Work.
Long Distance Lines.
Wire, Insulators, Exchanges, Switch Boards.
The Propagation of Energy.
The Telephone Current.
Measurement.
Properties of City Lines, Cables, Etc.
Price, $1.50.

"MANUAL OF TELEPHONY,"

BY W. H. PREECE AND ARTHUR T. STUBBS.
Price, $4.50.

"THE ELECTRIC TELEPHONE,"

BY G. B. PRESCOTT.
795 Pages. Price, $6.00.

"THE TELEPHONE,"

BY A. E. DOLBEAR.
Price, 50 Cts.

"THE TELEPHONE, MICROPHONE AND PHONOGRAPH,"

BY COUNT DU MONCEL.
Price, $1.25.

"THE TELEPHONING OF GREAT CITIES,"

BY A. R. BENNETT.
Price, 50 Cts.

"THE PRACTICAL TELEPHONE HAND BOOK,"

BY J. POOLE.
Price, $1.00.
A thoroughly practical manual of moderate size and cost, describing the latest development of the subject.

"TELEPHONE HAND BOOK,"

BY H. L. WEBB.
Price, $1.00.

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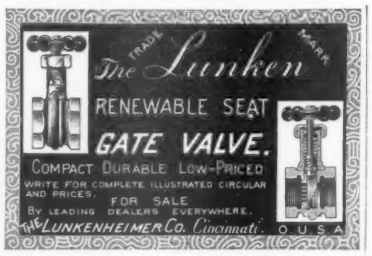

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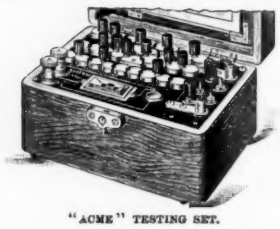

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